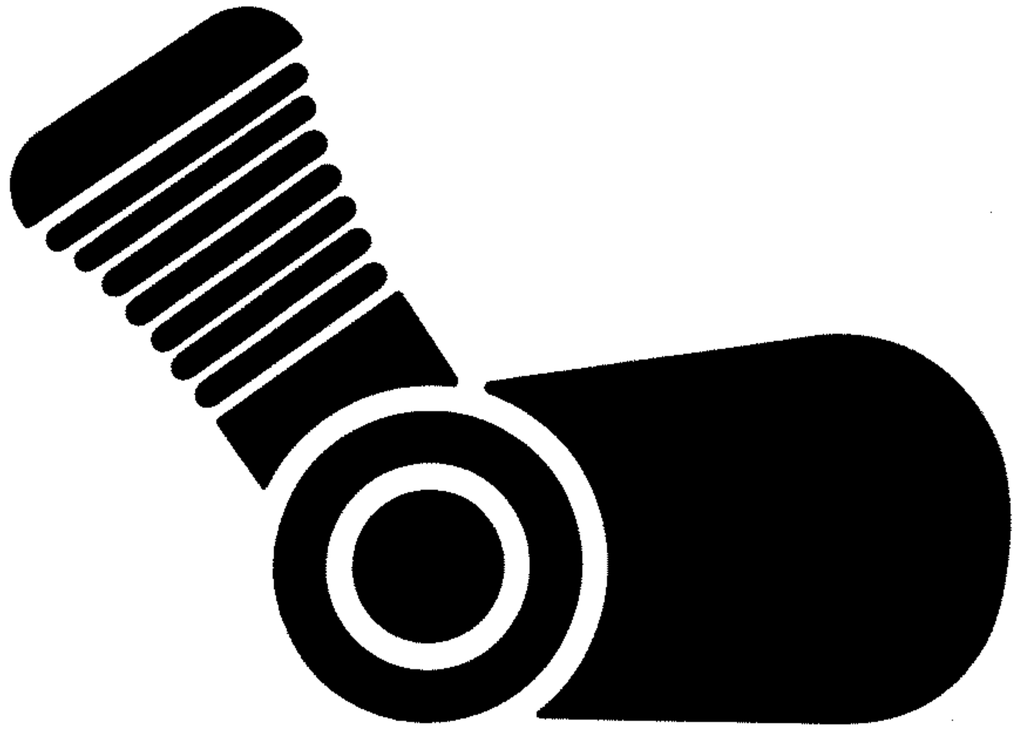

ENG 4

CHAPTER 4°

ENGINE OVERHAUL

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ENG

ENGINE OVERHAUL

ENGINE REMOVAL

NOTE:

It is not necessary to detach the engine from the chassis to remove the following parts:

- Cylinder head
- Cylinder
- Piston/Piston rings
- Clutch
- Water pump
- Oil pump
- Alternator

⚠ WARNING

Support the motorcycle securely to prevent it falling over.

COWLING, SEAT AND FUEL TANK

1. Remove:
   - Side panels (L and R)
   - Seat
   - Fuel tank

   See the section "COWLING" and "SEAT, FUEL TANK AND REAR COWLING" in chapter 3.

ENGINE OIL

1. Drain:
   - Engine oil

   See the section "ENGINE OIL REPLACEMENT" in chapter 3.

COOLING CIRCUIT

1. Drain:
   - Cooling circuit

   See the section "CHANGING THE COOLANT" in chapter 3.

BATTERY CABLES

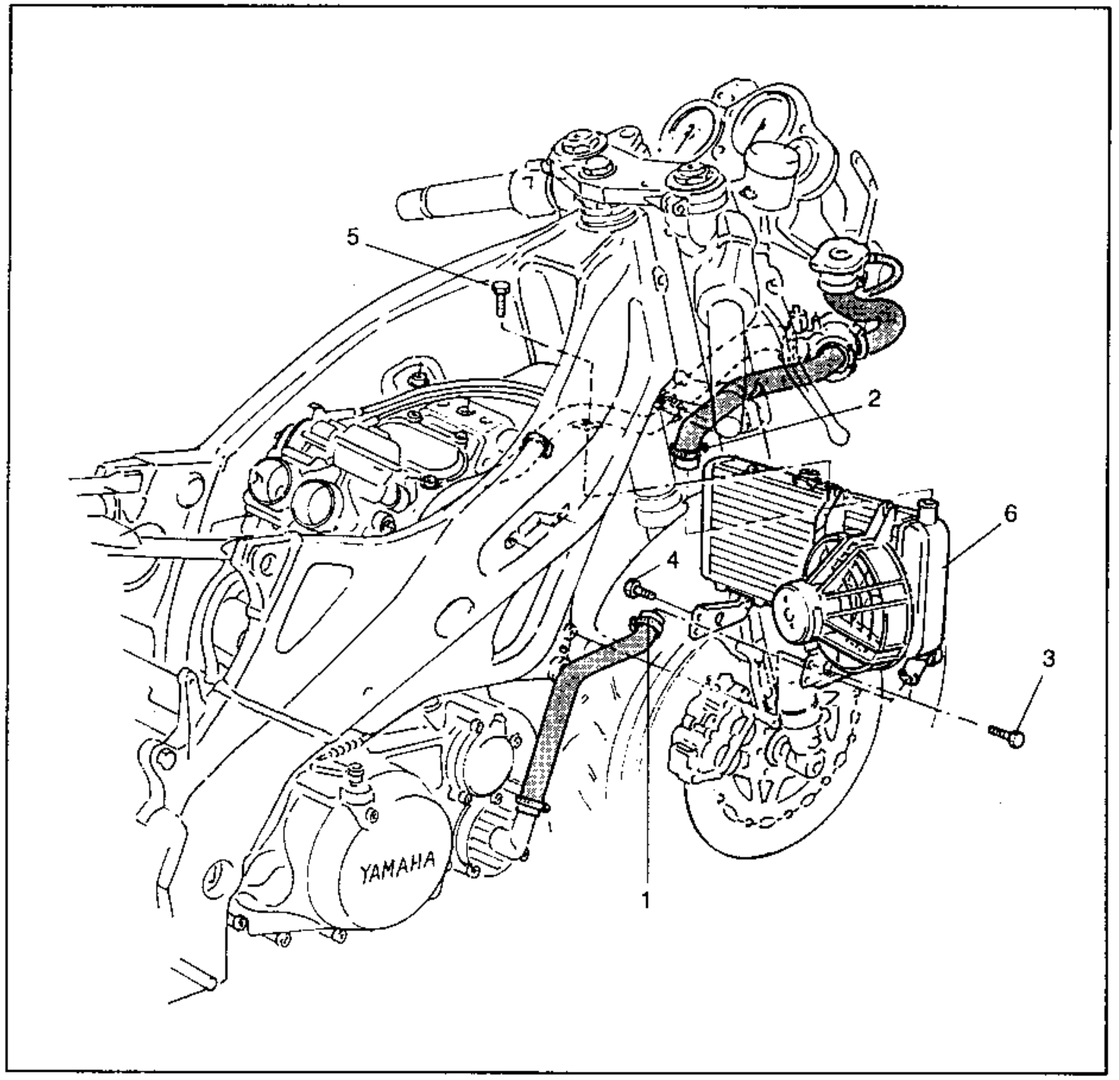
1. Disconnect:
   - Battery cables

CAUTION:

Disconnect first the negative cable (–), then the positive cable (+).

2. Remove:
   - Battery

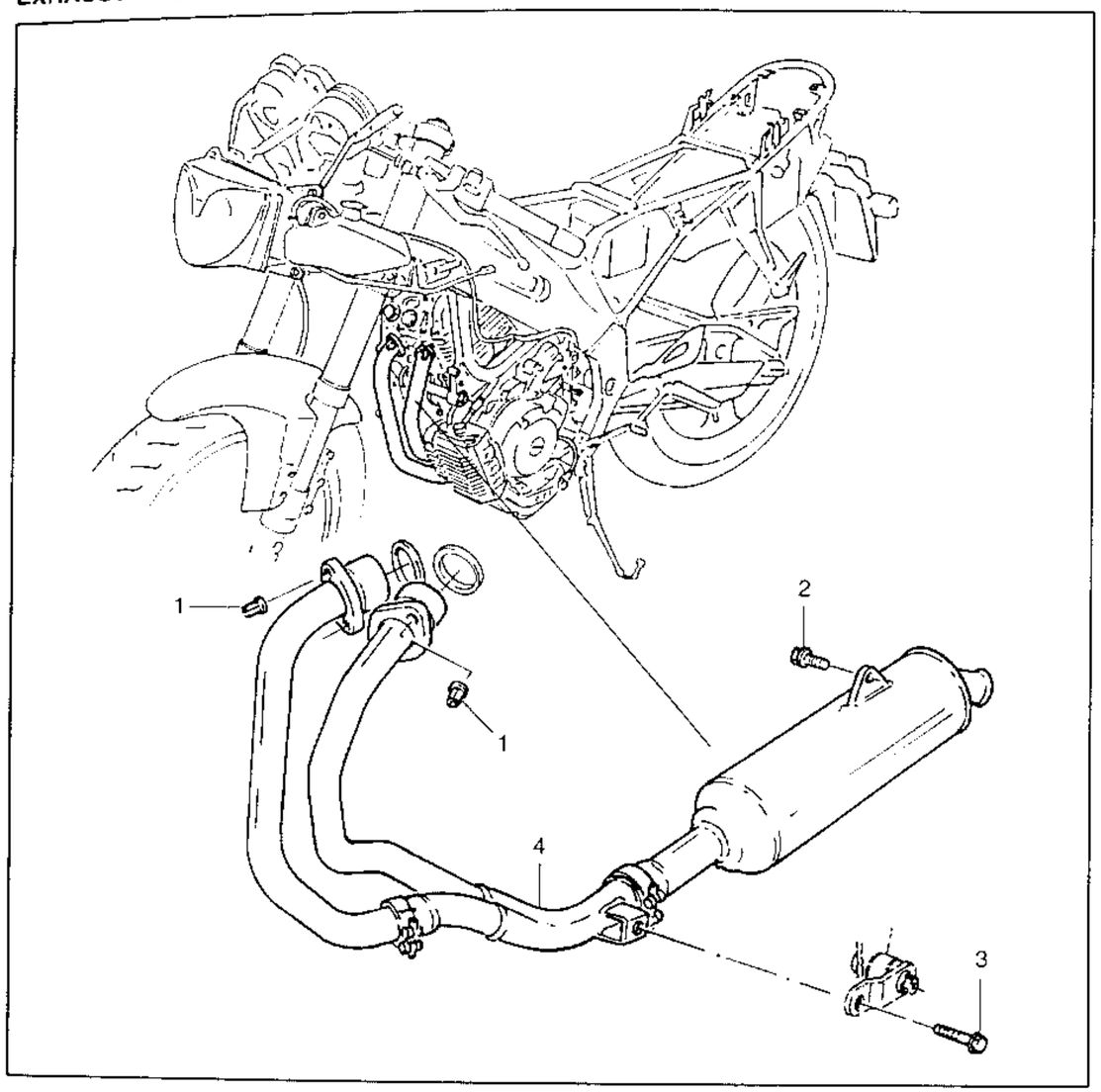
RADIATOR



JOB INSTRUCTION CHART

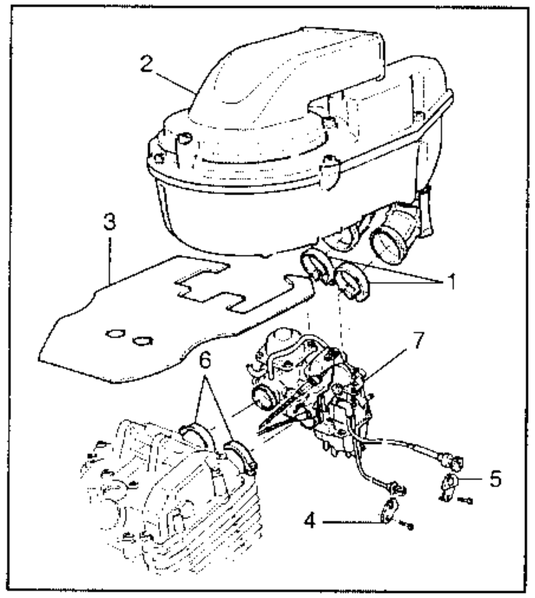
Order	Job name/Part name	Q.ty	Remarks
	Removal of radiator		**Remove the parts in the order.**
1	Clamp	1	
2	Clamp	1	
3	Screw	1	
4	Screw	1	
5	Screw	1	
6	Radiator (disconnect electrical connector)	1	**Reverse the removal procedure for installation.**

EXHAUST PIPE



JOB INSTRUCTION CHART

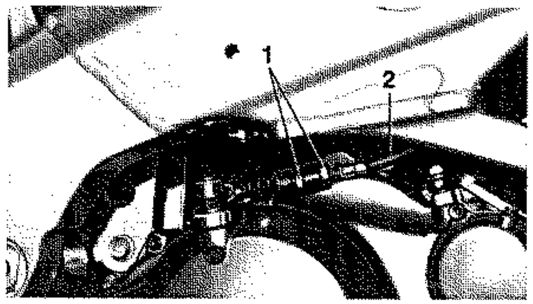
Order	Job name/Part name	Q.ty	Remarks
	Removal of exhaust pipe		**Remove the parts in the order.**
1	Nut	4	
2	Screw	1	
3	Screw	1	
4	Exhaust pipe (assembly)	1	
			Reverse the removal procedure for installation.



AIR FILTER CASE AND CARBURETOR

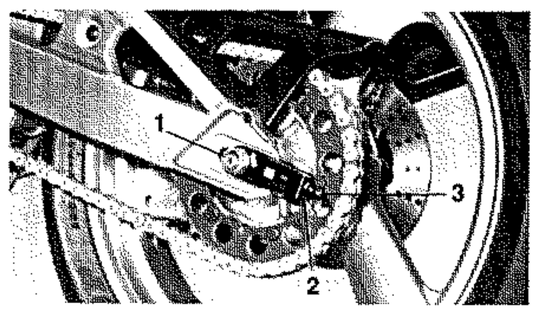
1. Loosen:
   - Carburetor manifold clamps (1)
2. Remove:
   - Air filter case (2)
   - Air panel (3)
3. Disconnect:
   - Engine idle speed control knob bracket (4)
   - Starter control knob bracket (5)
4. Loosen:
   - Carburetor joint clamps (6)
5. Remove:
   - Carburetors (7)

NOTE:
Cover the carburetor with a rag to prevent dirt or foreign bodies entering.



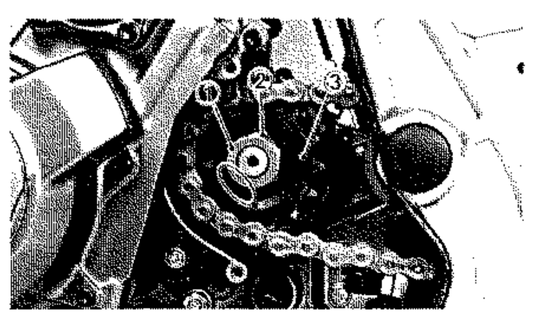
CLUTCH CABLE

1. Loosen:
   - Nut (1)
2. Disconnect:
   - Clutch cable (2)
     (from lever and bracket)



DRIVE CHAIN

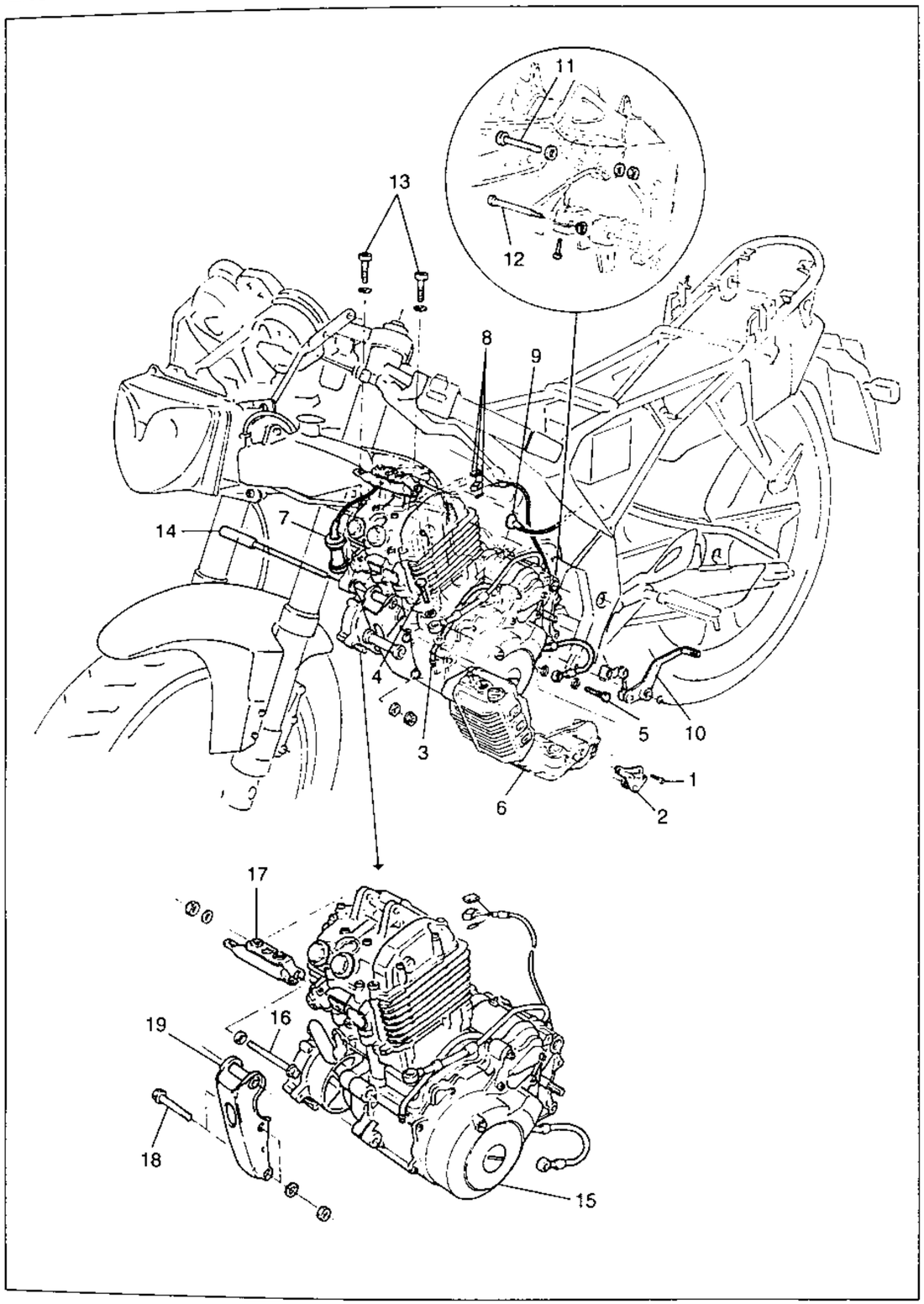
1. Loosen:
   - Rear wheel axle nut (1)
   - Lock nut (2) of the chain stretchers
   - Chain stretcher screws (3)
2. Remove:
   - Sprocket cover
3. Straighten:
   - Lock washer tab



4. Remove:
   - Nut (1)
   - Lock washer (2)
   - Sprocket (3)

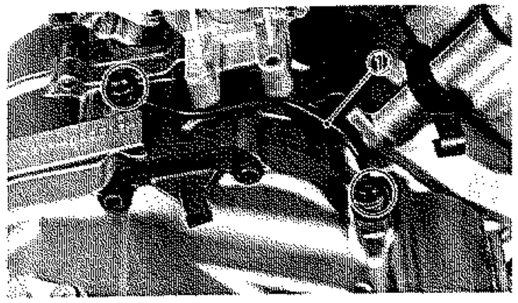
NOTE:
Loosen the sprocket nut (1) while applying the rear brake.

ENGINE DETACHMENT



JOB INSTRUCTION CHART

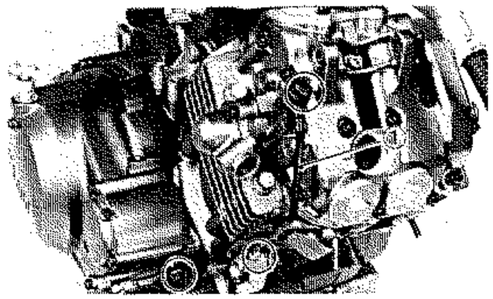
Order	Job name/Part name	Q.ty	Remarks
	Detachment of engine from frame		**Remove the parts in the order.**
1	Screw	2	
2	Bracket	1	
3	Crankcase ventilation hose	1	
4	Screw (oil recovery hose)	1	
5	Screw (oil delivery hose)	1	
6	Oil tank	1	
7	Spark plug cable	1	
8	Wire harness connector	3	
9	Starter plus leadwire	1	
10	Shift pedal	1	
11	Bolt (engine mounting)	1	
12	Screw (engine mounting)	1	
13	Screw (engine upper mounting)	2	
14	Axle (engine front mounting)	1	
15	Engine	1	
16	Bolt (engine upper mounting stay)	1	
17	Engine upper mounting stay	1	
18	Bolt (engine front mounting stay)	2	
19	Engine front mounting stay	1	**Reverse the removal procedure for installation.**



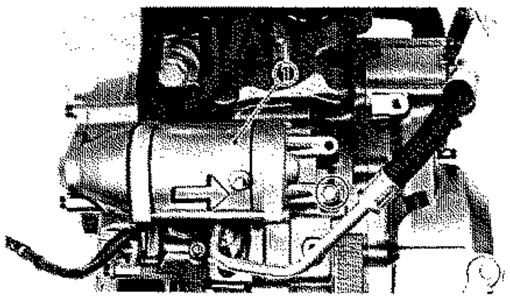
ENGINE DISASSEMBLY

STARTER MOTOR AND HOSES

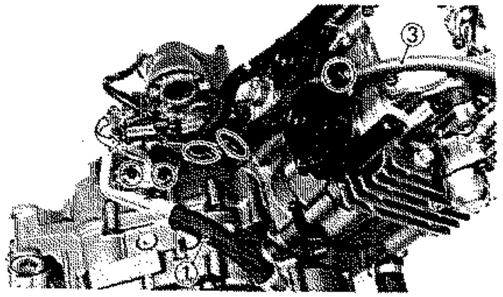
1. Remove:
   - Oil pipe (1)



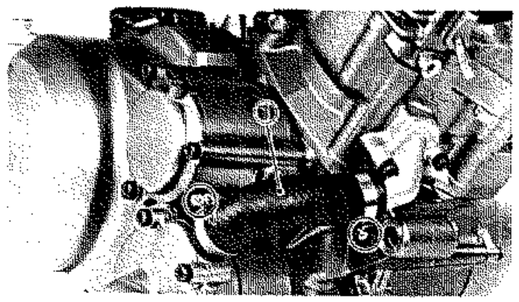
2. Remove:
   - Oil pipe (1)



3. Remove:
   - Starter motor (1)



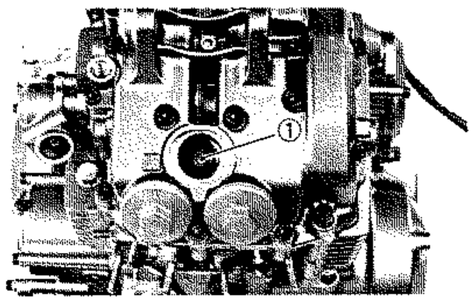
4. Remove:
   - Oil hose (1)
   - Breather hose (3) (crankcase)



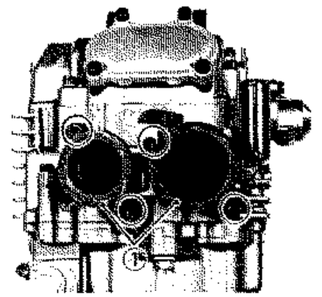
5. Remove:
   - Coolant hose (1)

CYLINDER HEAD, CYLINDER AND PISTON

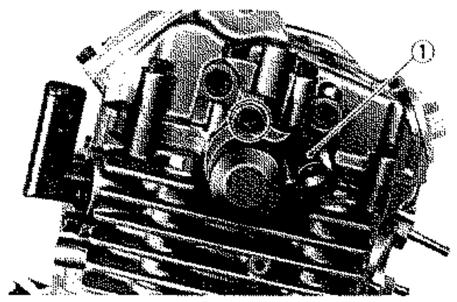
NOTE:
With the engine mounted, the cylinder head cover, camshaft and cylinder head can be maintained by removing the following parts.
- Seat
- Fuel tank
- Cowling
- Radiator
- Exhaust pipe
- Ignition coil
- Air filter case
- Air panel
- Carburetor



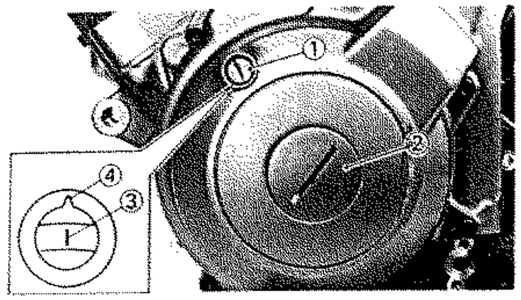
1. Remove:
   - Spark plug (1)



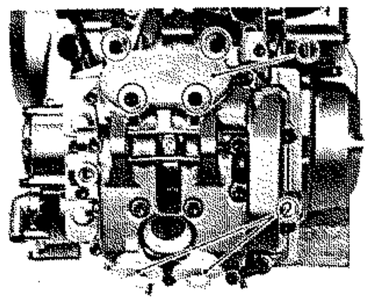
2. Remove:
   - Intake manifolds (1)



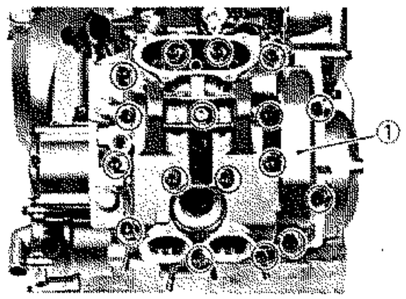
3. Remove:
   - Cap (1)



4. Remove:
   - Timing plug (1)
   - Plug (center) (2)
5. Turn:
   - Crankshaft
     (until TDC mark (3) is aligned with stationary pointer (4)

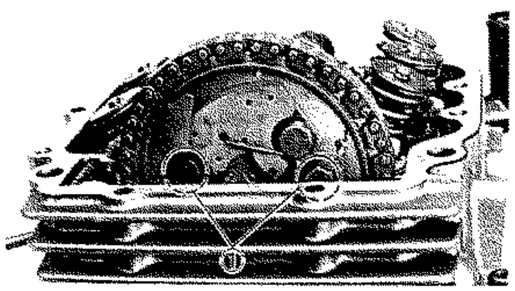


6. Remove:
   - Tappet cover (intake) (1)
   - Tappet cover (exhaust) (2)

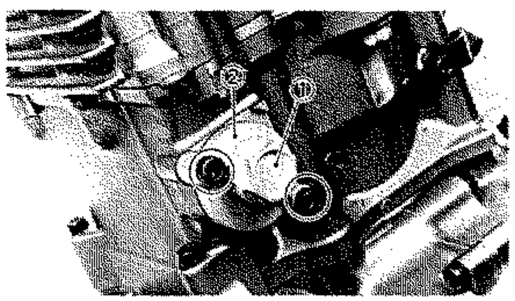


7. Remove:
   - Cylinder head cover (1)

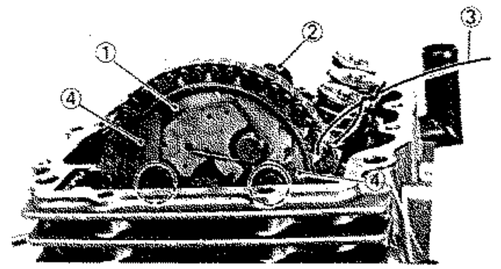
NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.



8. Loosen:
   - Bolts (1) (cam sprocket)

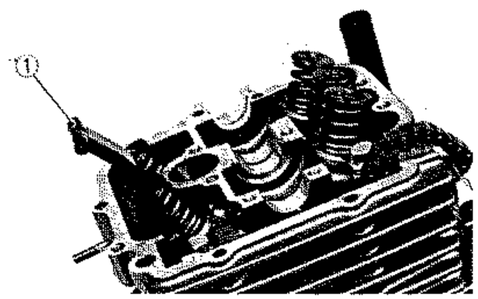


9. Loosen:
   - Cap bolt (1) (chain tensioner)
10. Remove:
    - Chain tensioner (2)

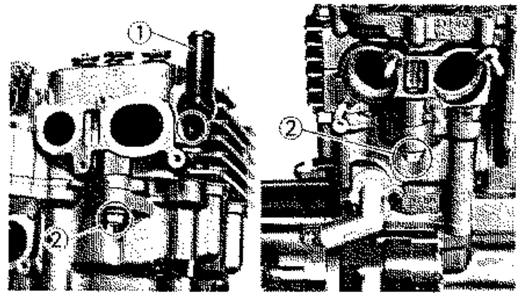


11. Remove:
    - Cam sprocket (1)
    - Camshaft (2)

NOTE:
- Fasten a safety wire (3) to the timing chain to prevent if from falling into the crankcase.
- Do not fall the stopper guide plate (4) into the crankcase when removing the bolts (cam sprocket).

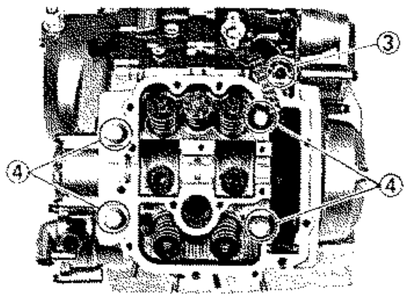


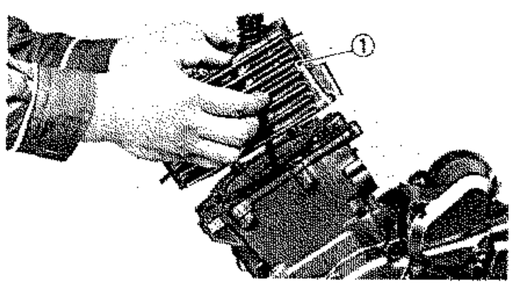
12. Remove:
    - Chain guide (1) (exhaust)



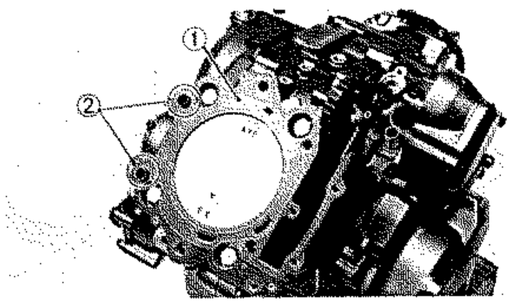
13. Remove:
    - Pipe (1)
    - O-Ring
    - Bolts (2)
    - Bolts (3)
    - Bolts (4)

NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.

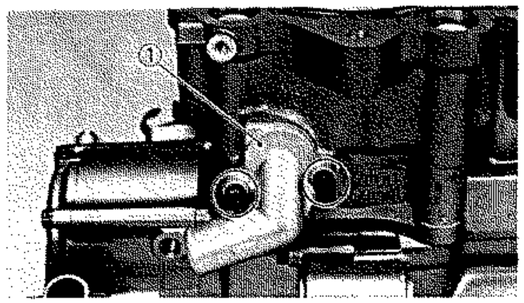




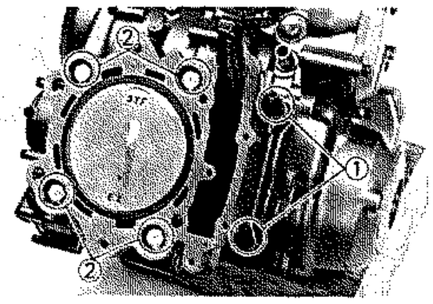
14. Remove:
    - Cylinder head (1)



15. Remove:
    - Gasket (1) (cylinder head)
    - Dowel pins (2)

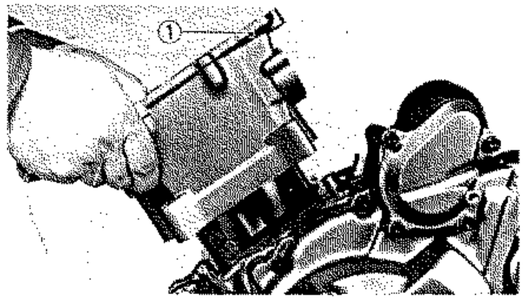


16. Remove:
    - Pipe (1)

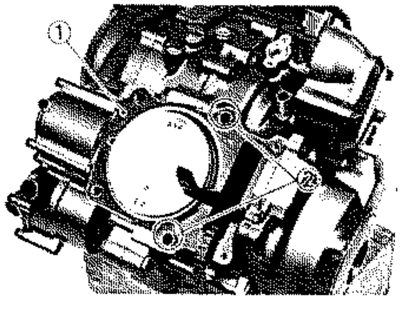


17. Remove:
    - Bolts (1)
    - Bolts (2)

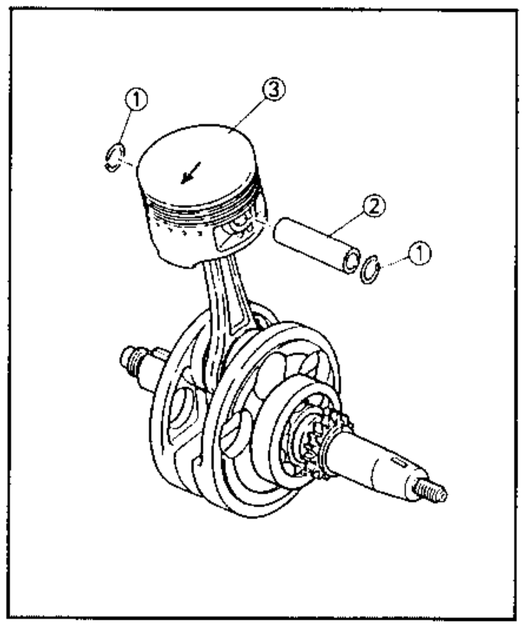
NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.



18. Remove:
    - Cylinder (1)



19. Remove:
    - Gasket (1) (cylinder)
    - Dowel pins (2)



20. Remove:
    - Piston pin circlips (1)
    - Piston pin (2)
    - Piston (3)

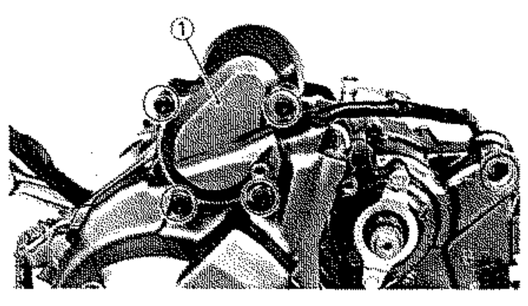
NOTE:
- Before removing the piston pin circlip, cover the crankcase with a clean rag to prevent the circlip from falling into the crankcase cavity.
- Before removing the piston pin, deburr the clip grooved and pin hole area. If the piston pin groove is deburred and piston pin is still difficult to remove, use the piston pin puller.

	Piston pin puller: **P/N YU-01304, 90890-01304**

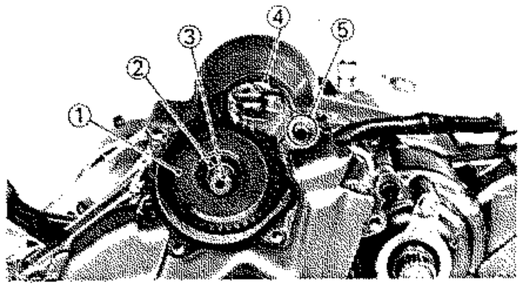
CAUTION:
Do not use a hammer to drive the piston pin out.

ROTOR AND STARTER DRIVERS

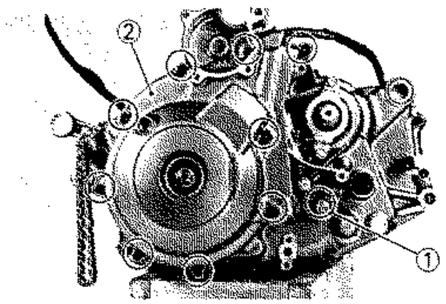
NOTE:
The AC magneto and starter drivers can be maintained with the engine mounted.



1. Remove:
    - Cover (1)

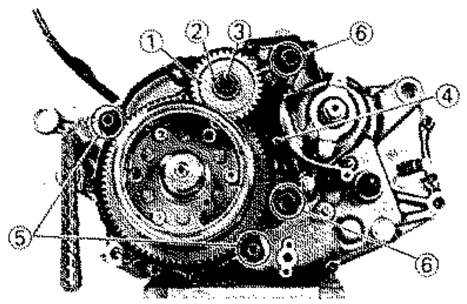


2. Remove:
   - Starter idle gear 1 (1)
   - Needle bearing (2)
   - Shaft (3)
   - Gasket (4)
   - Dowel pin (5)

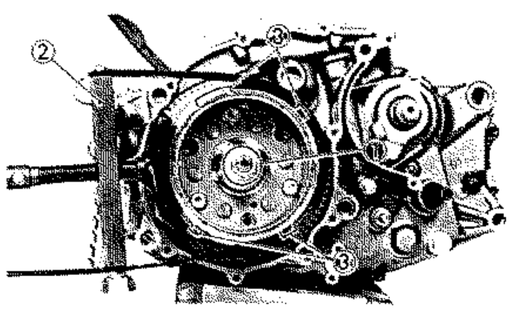


3. Disconnect:
   - Neutral switch lead (1)
4. Remove:
   - Crankcase cover (2) (left)

NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.



5. Remove:
   - Starter idle gear 2 (1)
   - Needle bearing (2)
   - Shaft (3)
   - Gasket (4) (crankcase cover)
   - Dowel pins (5)
   - O-rings (6)

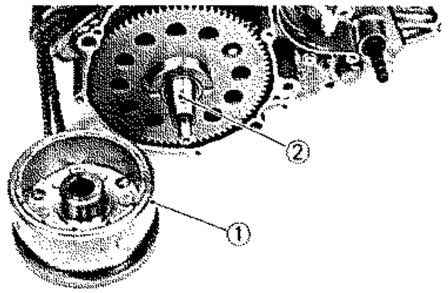


6. Remove:
   - Nut (1) (rotor)

NOTE:
Loosen the nut (rotor) while holding the rotor with the rotor holder (2).

	Rotor holder: **P/N YS-01880, 90890-01701**

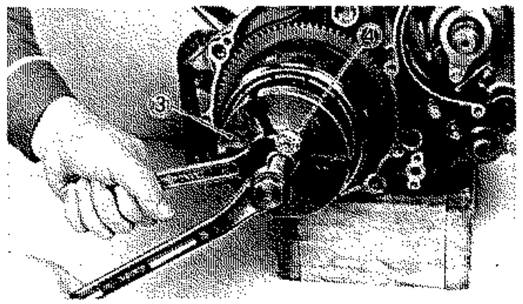
CAUTION:
Do not allow the rotor holder to touch the projection (3) on the rotor.

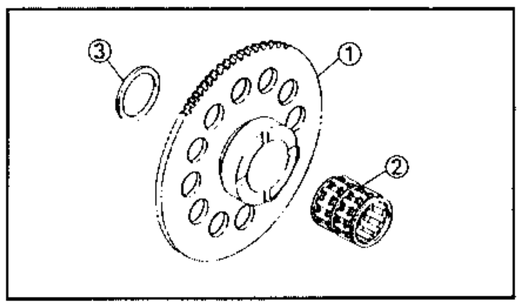


7. Remove:
   - Rotor (1)
   - Woodruff key (2)
   Use the rotor puller (3) and adapter (4).

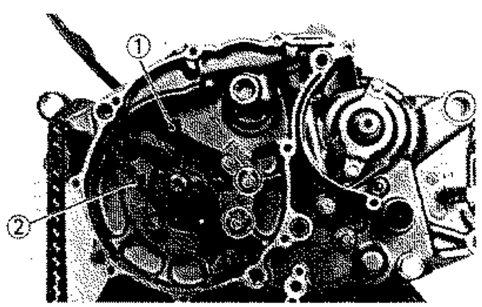
	Rotor puller: **P/N YU-33270, 90890-01362** **Adapter:** **P/N YM-04063-A, 90890-04063**

NOTE:
Tighten the tool holding bolts, but make sure that the tool body is parallel with the rotor. If necessary, one screw may be backed out slightly to level tool body.

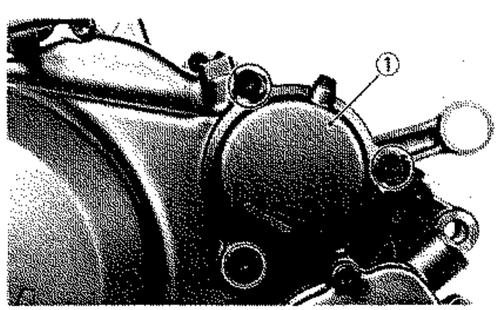




8. Remove:
   - Wheel gear (1)
   - Needle bearing (2)
   - Washer (3)



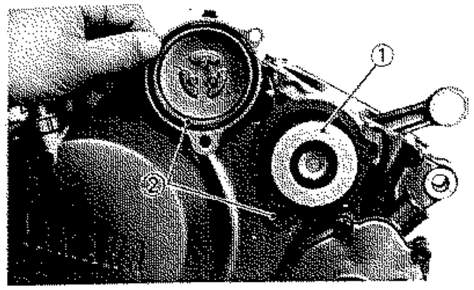
9. Remove:
   - Chain guide (1)
   - Timing chain (2)



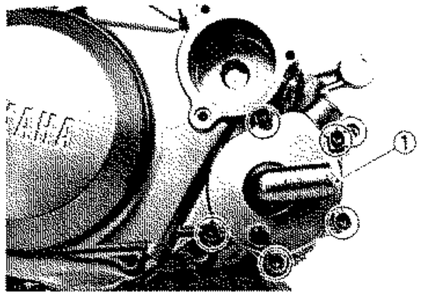
OIL FILTER AND WATER PUMP

NOTE:
The water pump can be maintained with the engine mounted.

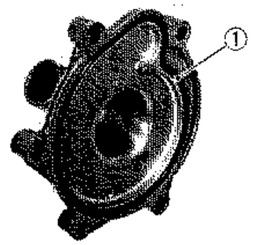
1. Remove:
   - Oil filter cover (1)



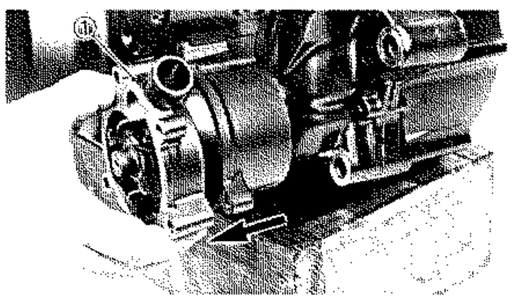
2. Remove:
   - Oil filter (1)
   - O-rings (2)



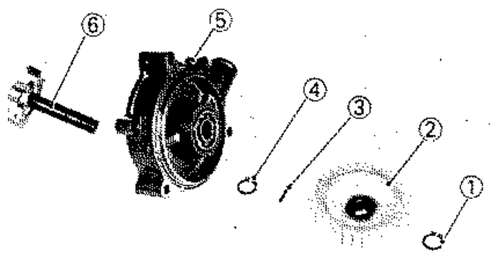
3. Remove:
   - Water pump cover (1)



4. Remove:
   - O-ring (1)



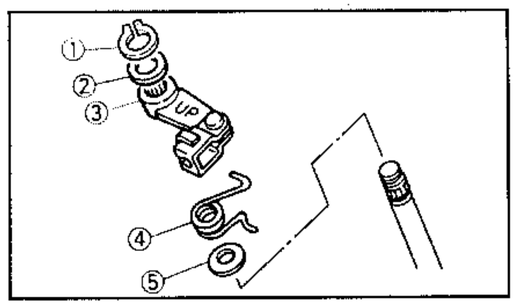
5. Remove:
   - Water pump housing (1)



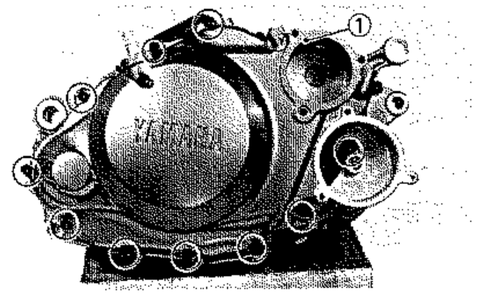
6. Remove:
   - Circlip (1)
   - Water pump gear (2)
   - Pin (3)
   - Circlip (4)
   - Water pump housing (5)
   - Impeller shaft (6)

CLUTCH AND BALANCER GEAR

NOTE:
With the engine mounted, the clutch can be maintained by removing the following parts:
- Side panel (R)
- Clutch cable
- Water pump housing

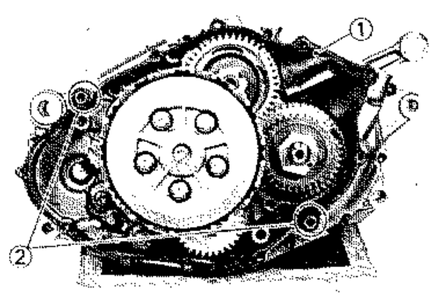


1. Remove:
   - Circlip (1)
   - Washer (2)
   - Pull lever (3)
   - Return spring (4)
   - Washer (5)

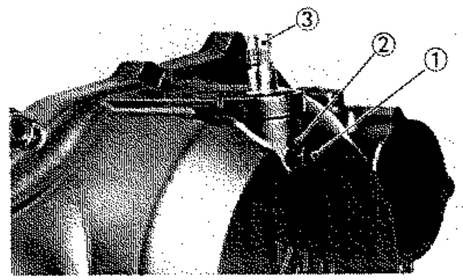


2. Remove:
   - Crankcase cover (1) (right)

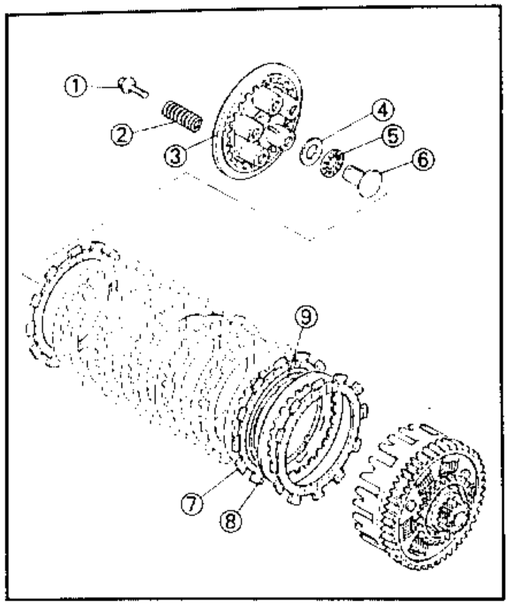
NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.



3. Remove:
   - Gasket (1) (crankcase cover)
   - Dowel pins (2)

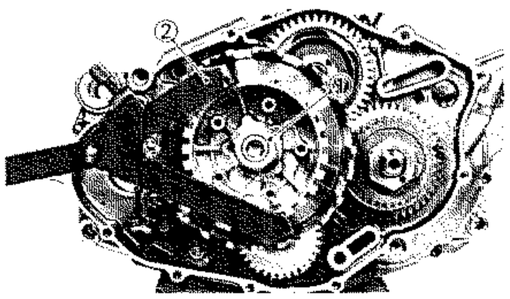


4. Remove:
   - Bolt (1)
   - Washer (2)
   - Pull lever axle (3) (from crankcase cover)



5. Remove:
   - Bolts (1)
   - Clutch springs (2)
   - Pressure plate (3)
   - Washer (4)
   - Bearing (5)
   - Pull rod (6)
   - Friction plate (7)
   - Clutch plate (8)
   - Cushion spring (9)

NOTE:
Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.

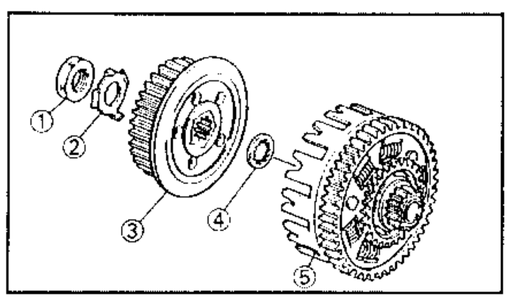


6. Straighten:
   - Lock washer tab

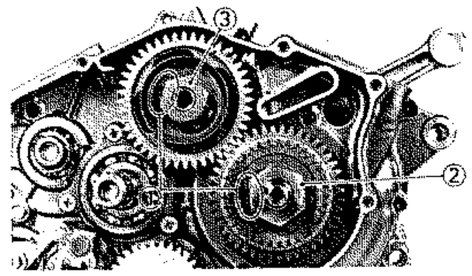
7. Loosen:
   - Nut (1) (clutch boss)

NOTE:
Loosen the nut (clutch boss) while holding the clutch boss with universal clutch holder (2).

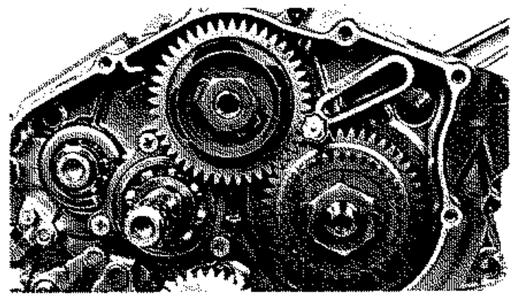
	Universal clutch holder: P/N YM-91042, 90890-04086



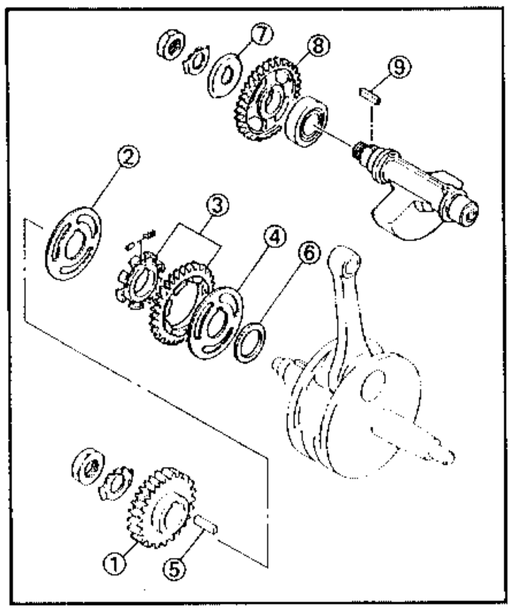
8. Remove:
   - Nut (1) (clutch boss)
   - Lock washer (2)
   - Clutch boss assembly (3)
   - Thrust plate (4)
   - Clutch housing (5)



9. Straighten:
   - Lock washer tabs (1)
10. Loosen:
   - Nut (2) (crankshaft)
   - Nut (3) (balancer shaft)



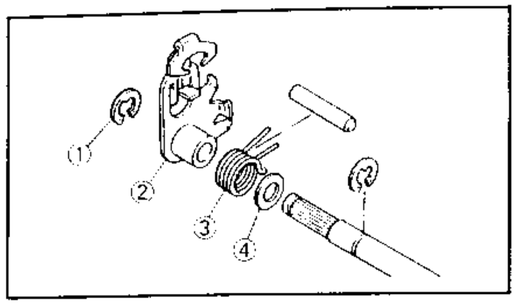
NOTE:
- Place a folded rag or aluminum plate between the teeth of the balancer drive gear and balancer gear.
- Take care not to damage the gear teeth.



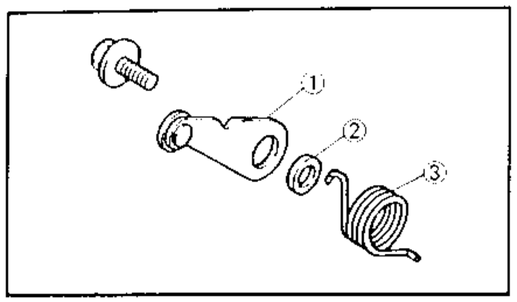
11. Remove:
   - Primary drive gear (1)
   - Plate (2)
   - Balancer drive gear (3)
   - Plate (4)
   - Key (5)
   - Plater washer (6)
   - Plate (7)
   - Balancer gear (8)
   - Key (9)

SHIFT LEVER AND OIL PUMP

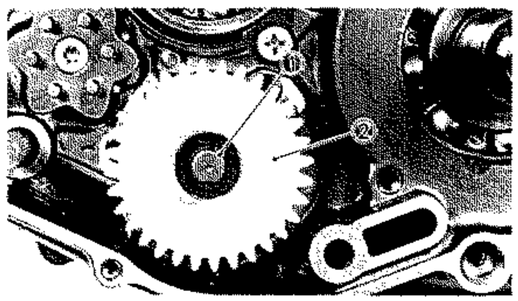
NOTE:
- With the engine mounted, the oil pump can be maintained by removing the following parts:
- Clutch cable
- Water pump housing



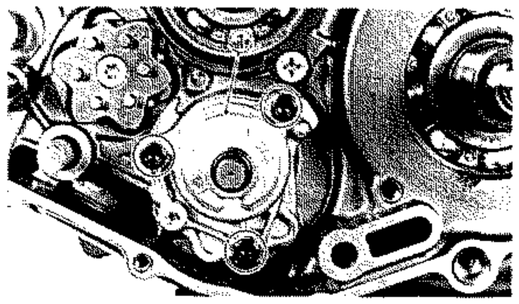
1. Remove:
   - Circlip (1)
   - Shift lever (2)
   - Torsion spring (3)
   - Washer (4)



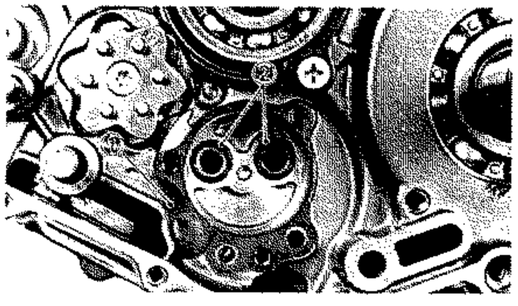
2. Remove:
   - Stopper lever (1)
   - Collar (2)
   - Return spring (3)



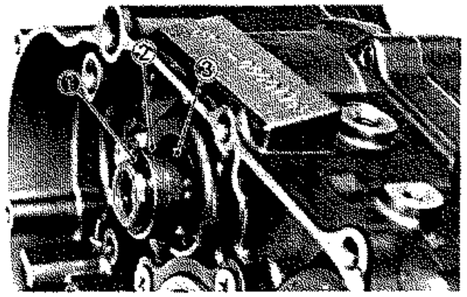
3. Remove:
   - Circlip (1)
   - Oil pump gear (2)



4. Remove:
   - Oil pump assembly (1)



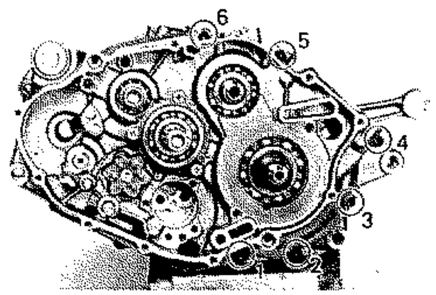
5. Remove:
   - Gasket (1)
   - O-ring (2)

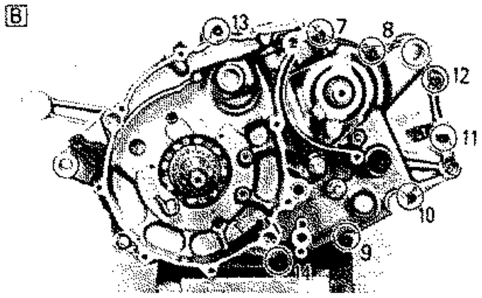


6. Remove:
   - Circlip (1)
   - Collar (2)
   - Circlip (3)

CRANKCASE (RIGHT)

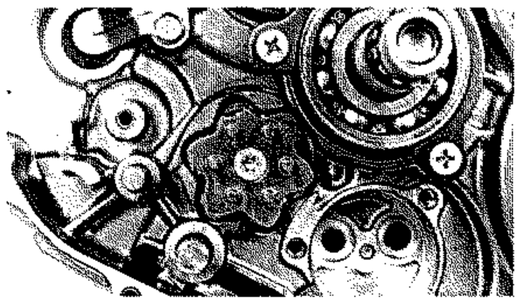
1. Remove:
   - Bolts (crankcase)



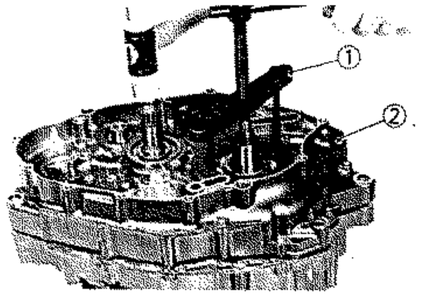


A Crankcase (right)
B Crankcase (left)

NOTE:
- Loosen the bolts 1/4 turn each and remove them after all are loosened.
- Loosen the bolts starting with the highest numbered one.
- The embossed numbers in the crankcase designate the tightening sequence.



NOTE:
Turn the shift cam to the position shown in the figure so that it does not contact the crankcase when separating the crankcase.



2. Attach:
   - Crankcase separating tool (1)

	Crankcase separating tool: **P/N YU-01135-A, 90890-01135**

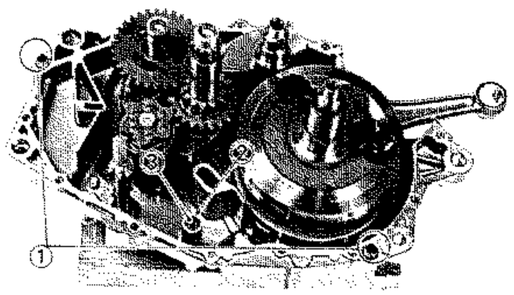
3. Remove:
   - Crankcase (right) (2)

NOTE:

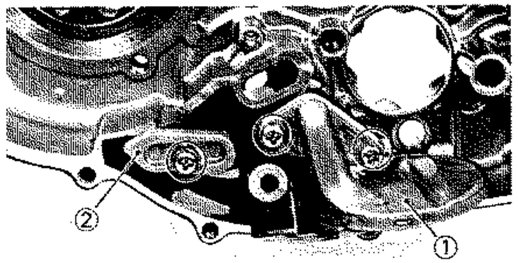
- Fully tighten the tool holding bolts, but make sure the tool body is parallel with the case. If necessary, one screw may be backed out slightly to level tool body.
- As pressure is applied, alternately tap on the front engine mounting boss, transmission shafts, and shift cam.

CAUTION:

Use soft hammer to tap on the case half. Tap only on reinforced portions of case. Do not tap on gasket mating surface. Work slowly and carefully. Make sure the case halves separate evenly. If one end "hans up" take pressure off the push screw, realign, and start over. If the cases do not separate, check for a remaining case screw or fitting. Do not force.

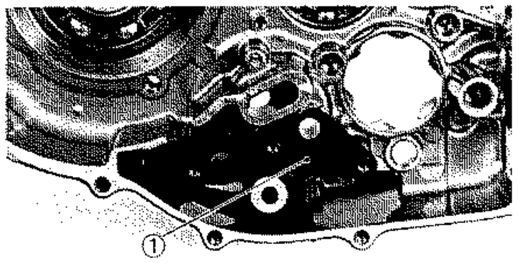


4. Remove:
   - Dowel pins (1)
   - Dowel pin (2)
   - O-ring (3)

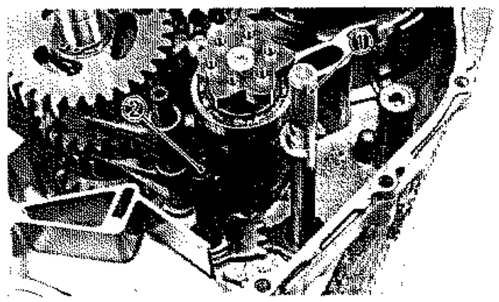


OIL STRAINER

1. Remove:
   - Oil strainer (1)
   - Oil passage cover (2)

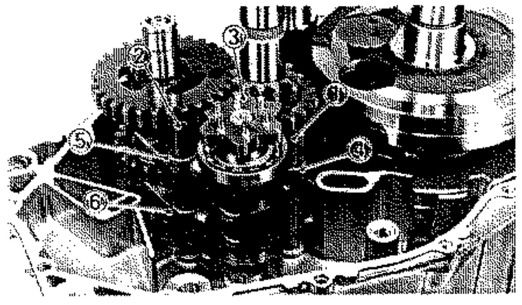


2. Remove:
   - Gasket (1) (oil strainer)

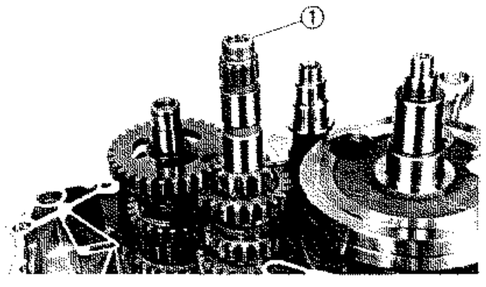


BALANCER, TRANSMISSION AND SHIFTER

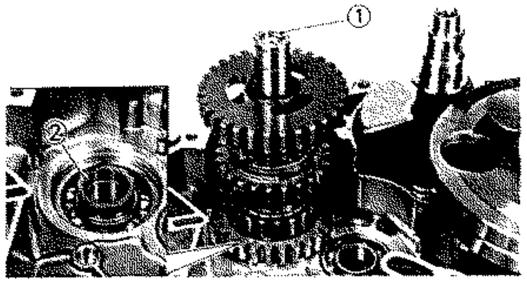
1. Remove:
   - Shift shaft (1)
   - Shift shaft 2 (2)



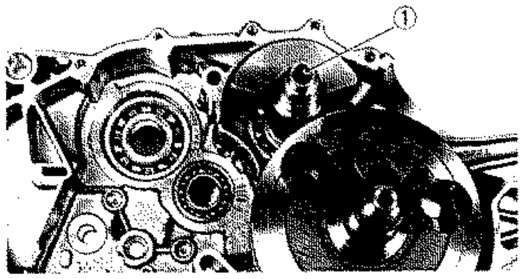
2. Remove:
   - Guide bar (1) (short)
   - Guide bar (2) (long)
   - Shift cam (3)
   - Shift fork 2 "C" (4)
   - Shift fork 3 "R" (5)
   - Shift fork 1 "L" (6)



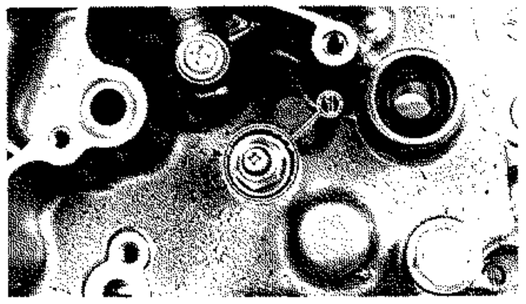
3. Remove:
   - Main axle assembly (1)



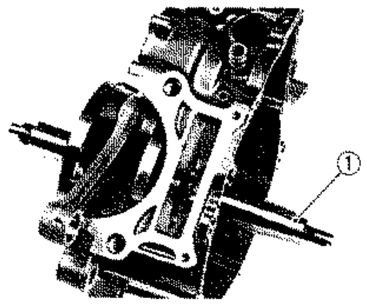
4. Remove:
   - Drive axle assembly (1)
   - Collar (2)

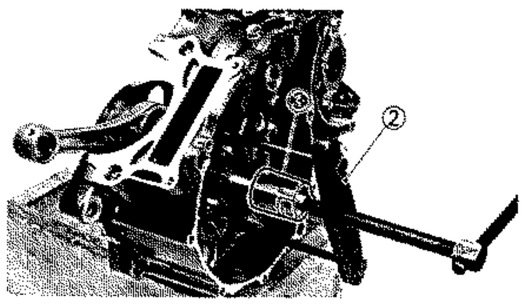


5. Remove:
   - Balancer shaft (1)



6. Remove:
   - Neutral switch (1)





CRANKSHAFT

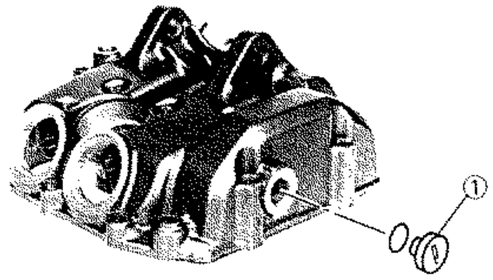
1. Remove:
   - Crankshaft assembly (1)
     Use the crankcase separating tool (2) and adapter (3).

	Crankcase separating tool: **P/N YU-01135-A, 90890-01135** **Adapter:** **P/N YM-04063-A, 90890-04063**

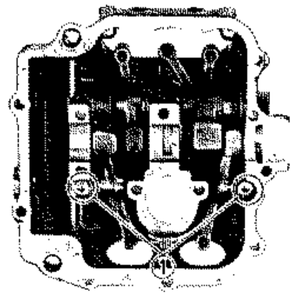
NOTE:
Tighten the tool holding bolts, but make sure that the tool body is vertical with the crankshaft. If necessary, one screw may be backed out slightly to level tool body.

ROCKER ARM

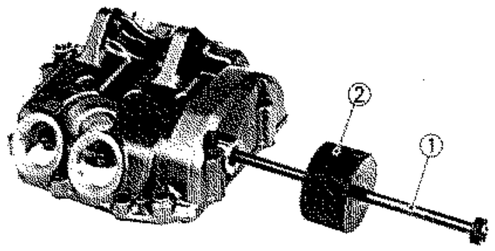
NOTE:
With the engine mounted, the rocker arm can be maintained by removing the following parts:
- Cowling
- Seat
- Fuel tank
- Radiator
- Exhaust pipes
- Cylinder head cover



1. Remove:
   - Plug (1)



2. Remove:
   - Bolts (1) (rocker arm shaft)



3. Remove:
   - Rocker arm shaft
   - Rocker arm

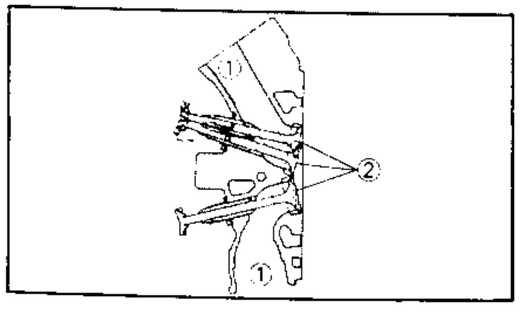
NOTE:
Remove the rocker arm shaft by the slide hammer bolt (1) and weight (2).

	Slide hammer set: **P/N YU-01083-A** **Slide hammer bolt:** **P/N 90890-01083** **Weight:** **P/N 90890-01084**

VALVES

NOTE:
Before removing the internal parts (valve, valve spring, valve seat, etc.) of the cylinder head, the valve sealing should be checked.

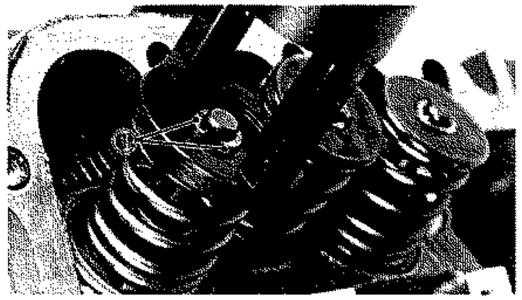
1. Check:
   - Valve sealing
     Leakage at valve seat → Inspect the valve face, valve seat and valve seat width.
     Refer to the "INSPECTION AND REPAIR - VALVE SEAT" section.



* *

Checking steps:
- Pour a clean solvent (1) into the intake and exhaust ports.
- Check the valve sealing.
  There should be no leakage at the valve seat (2).

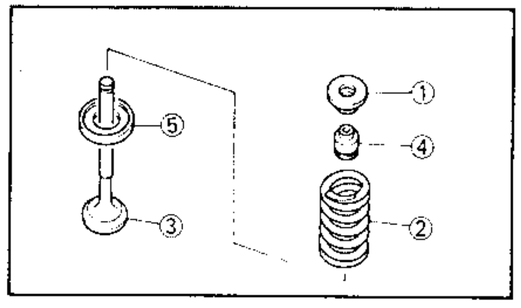
* *



2. Remove:
   - Valve cotters (1)

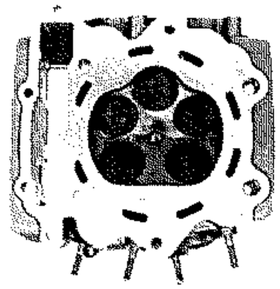
NOTE:
Remove the valve cotters while compressing the valve spring with the valve spring compressor.

	Valve spring compressor: **P/N YM-04019, 90890-04019**



3. Remove:
   - Valve retainer (1)
   - Valve spring (2)
   - Valve (3)
   - Oil seal (4)
   - Spring seat (5)

NOTE:
Identify each part position very carefully so that it can be reinstalled in its original place.



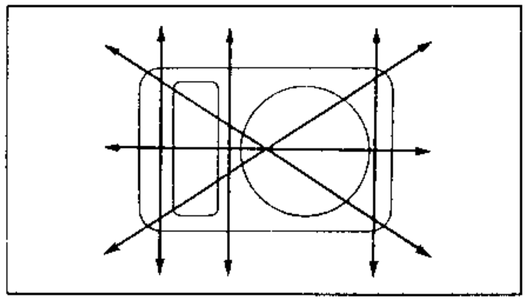
INSPECTION AND REPAIR

CYLINDER HEAD

1. Eliminate:
   - Carbon deposits
     (from combustion chamber)
     Use a rounded scraper.

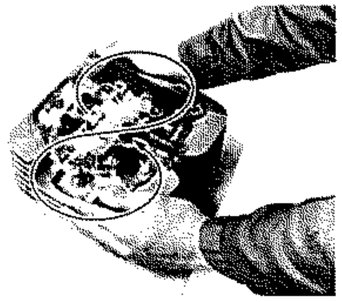
NOTE:
Do not use a pointed tool to avoid damaging or scratching:
- spark plug thread
- valve seats
- combustion chamber

2. Inspect:
   - Cylinder head
     Scratches/Damage → Replace.
   - Water jacket
     Crust of minerals/Rust → Eliminate.



3. Measure:
   - Deformation
     Out of specification → Rework the surface.

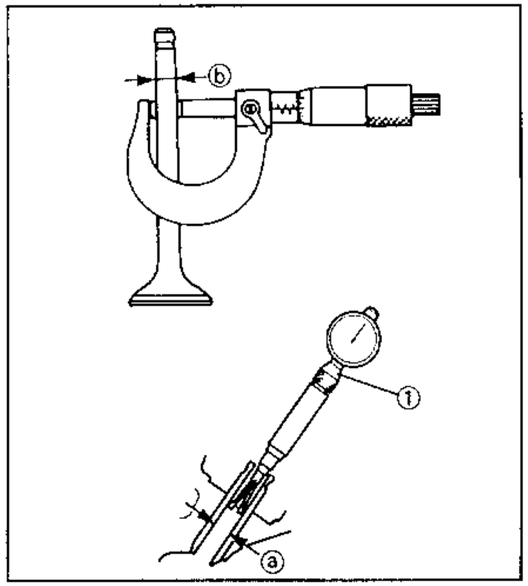
	Cylinder head deformation: **Less than 0.03 mm**

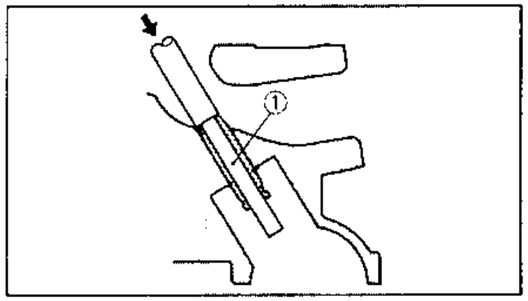


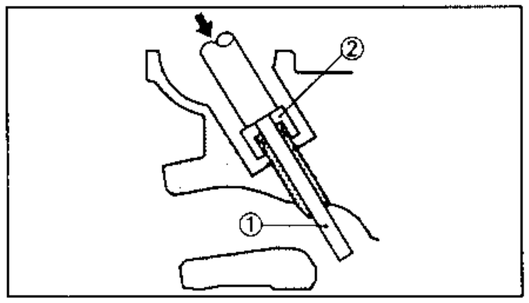
4. Surface:
   - Cylinder head

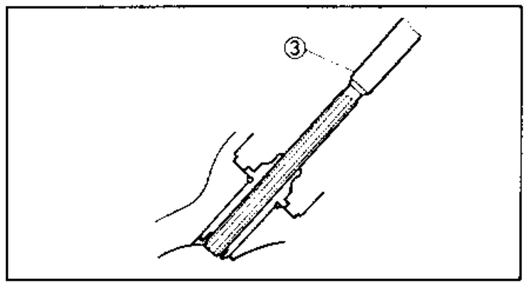
Levelling:
Level the cylinder head with wet 400 ~ 600 emery paper in a figure-8 direction.

NOTE:
To avoid removing too much material on one side only, turn the cylinder head a number of times.









VALVES AND VALVE GUIDES

1. Measure:
   - Clearance between stem and guide

Clearance between stem and guide =
Internal diameter of valve guide (a) –
Diameter of valve stem (b)

Out of specification → Replace valve guide.

	Clearance between stem and guide:
Intake:	**0.010 ~ 0.037 < Limit >: 0.08 mm**
Exhaust:	**0.025 ~ 0.052 < Limit >: 0.10 mm**

(1) Bore gauge

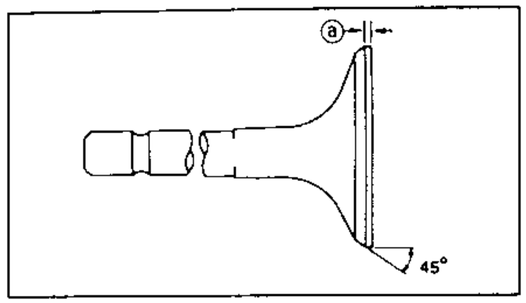
2. Replace:
   - Valve guide

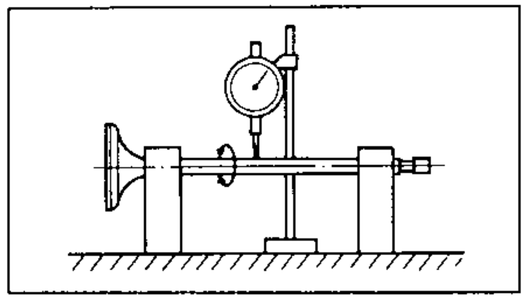
Replacement:

NOTE:
Heat the cylinder head in an oven at 100°C to facilitate the removal and installation of the guides and to maintain correct locking interference.

- Remove the valve guide using the special punch (1).
- Install the new guide using the special installation tool (2).
- After installing the valve guide, bore with special tool (3) to obtain valve-guide free play.

6 mm guide valve puller:
P/N YM-04064-A
P/N 90890-04064
6 mm valve guide installer:
P/N YM-04065
P/N 90890-04065
6 mm valve guide borer:
P/N YM-04066
P/N 90890-04066





NOTE:
Reface the valve seat after replacing the valve guide.

3. Clean the valve surfaces of the carbon deposits.
4. Inspect:
   - Valve seal surface
     Pitting/Wear → Grind the valve seal surface.
5. Measure:
   - Edge thickness (a)
     Out of specification → Reface.

Edge thickness limit:
0.8 mm

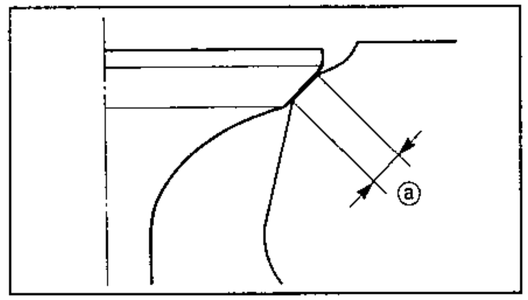
6. Check:
   - Valve stem tip
     Deformed, mushroom-shaped or with a higher diameter than the rest of the stem → Replace valve.
   - Misalignment (valve stem)
     Out of specification → Replace valve.

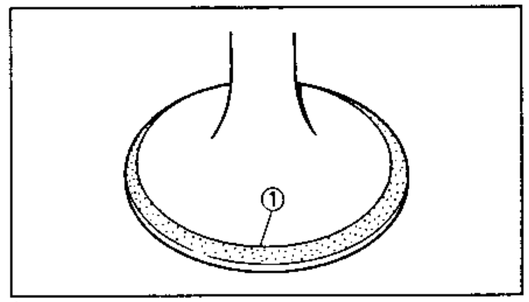
Stem offsettig limit:
0.01 mm

NOTE:
- Changing the valve, replace also the valve guide.
- Pulling the valve out, replace the oil seal.

VALVE HOUSING

1. Clean the valve surface and seat of carbon deposits.
2. Inspect:
   - Valve seat
     Pitting/Wear → Renew valve seat.

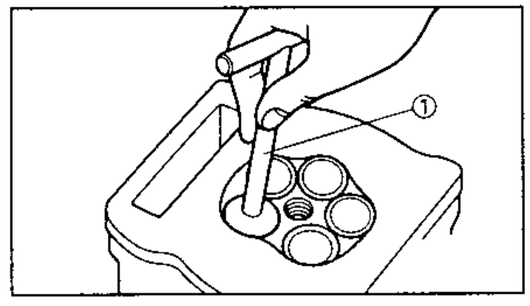




3. Measure:
   - Valve seat width (a)
     Out of specification → Renew valve seat.

Valve seat width:	
Intake:	0.9 ~ 1.1 mm
Exhaust:	0.9 ~ 1.1 mm

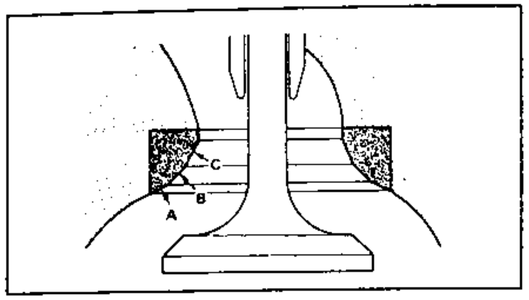
Measurement stages:
- Apply Prussian blue (Dykem) to the valve seat (1).
- Install the valve in the cylinder head.
- Press the valve onto the seat through the guide to leave a clear outline.
- Measure the width of the valve seat. Where there is contatc between valve and seat the Prussian blue is wiped away.
- If the valve seat is too narrow, wide or off-centre, the valve seat must be renewed.



4. Renew:
   - Valve seat
     Use the special tool to renew the valve seat (1) with 30°, 45° and 60° mills.

Valve seat milling unit:
P/N. YM-91043

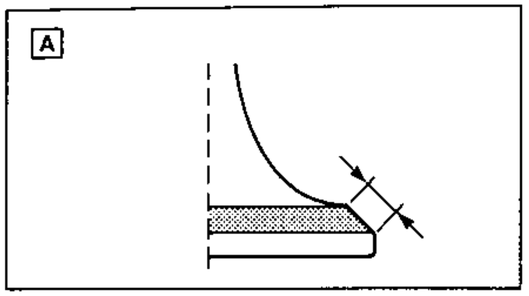
CAUTION:
Turning the milling tool, maintain uniform pressure (about 4-5 kg) to avoid leaving marks on the valve seat.



Mill the valve seat as follows	
Section	Mill
A	30°
B	45°
C	60°

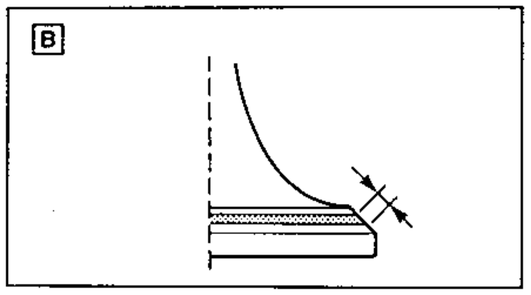
Valve seat faults recorded by analysing the valve seal surface:

[A] If the valve surface resembles that shown in the figure, this means that the valve seat is centred on the surface but is too wide.



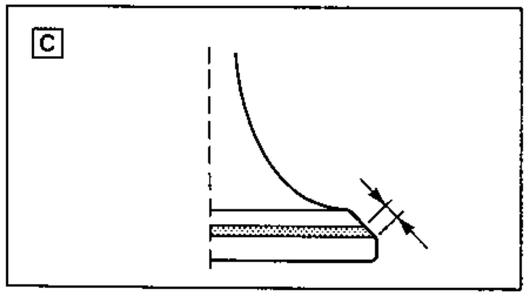
Intervention on the valve seat		Desired effect
Mill type:	30°	Reduce valve seat width to 1.0 mm
	60°	

[B] If the valve surface is like this, it means that the valve seat is centred on the valve surface but is too narrow.



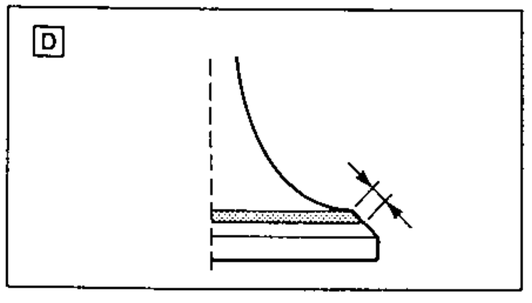
Intervention on the valve seat		Desired effect
Mill type:	45°	Increase valve seat width to 1.0 mm

[C] If the valve surface is like this, it means that the valve seat is too narrow and close to the edge of the valve.



Intervention on the valve seat		Desired effect
Mill type:	30° (before)	Centring of seat and attainment of 1.0 mm width
	45°	

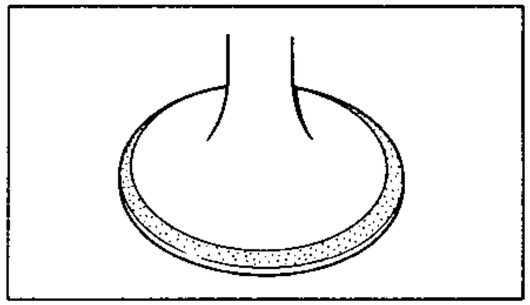
[D] If the valve surface is like this, it means that the valve seat is too narrow and situated low down near the lower edge of the valve surface.



Intervention on the valve seat		Desired effect
Mill type:	60° (before)	Centring of seat and attainment of 1.0 mm width
	45°	

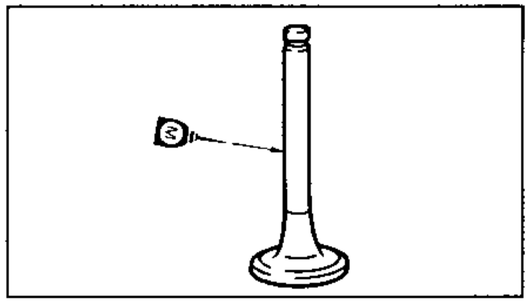
5. Emery:
   - Principal valve surface
   - Valve seat

NOTE:
If the valve seat is renewed or the valve and guide replaced, the valve seat and seal surface must be lapped.

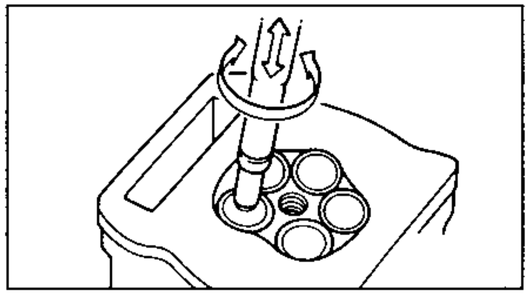


Lapping:
- Apply rough-lapping compound to the valve seal surface.

CAUTION:
Make sure the lapping compound does not run into the space between the guide and valve stem.



- Apply oil to the molybdenum disulfide on the valve stem.
- Install the valve in the cylinder head.



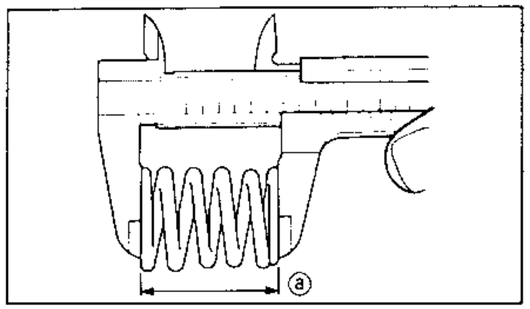
- Turn the valve until face and surface are not evenly polished. Then clean away all the lapping compound.

NOTE:
For best results, during lapping, repeatedly apply (light) pressure to the valve seat, turning the valve backwards and forwards by hand.

- Apply a fine-lapping compound on the valve seal surface and repeat the procedures described above.

NOTE:
Be sure to remove all the lapping compound from the valve surface after every lapping operation.

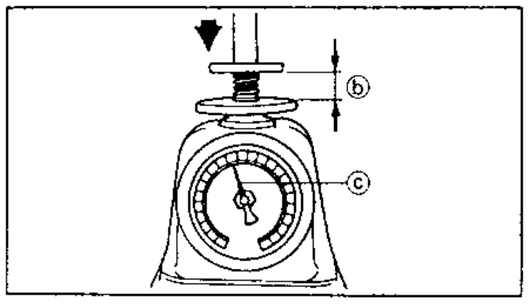
- Apply Prussian blue (Dykem) to the valve seal surface.
- Install the valve in the cylinder head.
- Press the valve onto the seat through the guide to leave a clear outline.
- Measure the valve seat width once more. If the width of the valve is out of specification alter and relap.



VALVE SPRING

1. Measure:
   - Free width of valve spring (a)
     Out of specification → Replace.

Free width (a) of valve spring:	
Intake	**Exhaust**
32.63 mm	**36.46 mm**

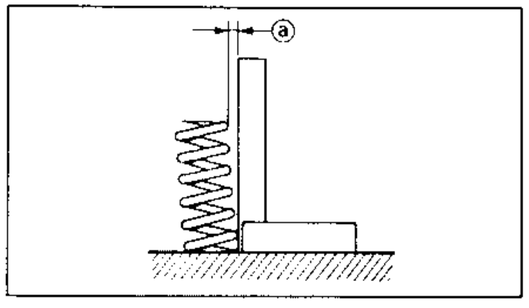


2. Measure:
   - Spring load
     Out of specification → Replace.

(b) Length of loaded spring

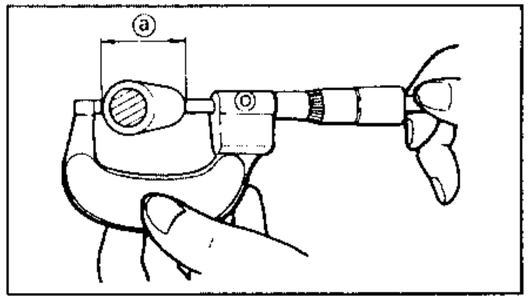
Valve spring load:
Intake:
(c) 10.2 ~ 11.8 kg
(b) 27.50 mm

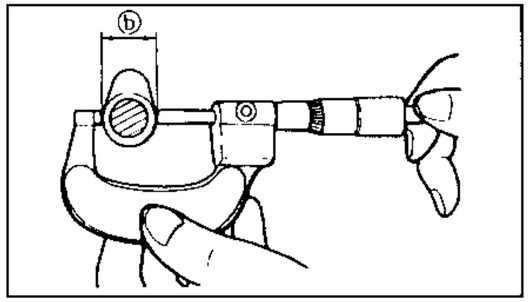
Exhaust:
(c) 12.3 ~ 14.1 kg
(b) 31.00 mm

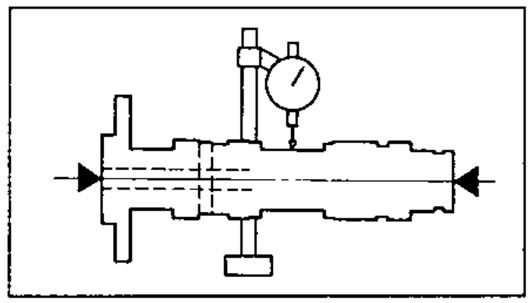


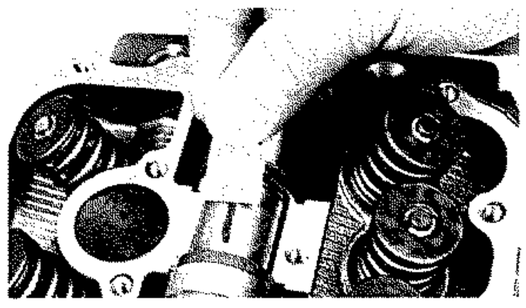
3. Measure:
   - Inclination of spring (a)
     Out of specification → Replace.

Inclination of spring:	
Intake	**Exhaust**
Lower than 1.4 mm	**Lower than 1.6 mm**









CAMSHAFT

1. Inspect:
   - Cam eccentrics
     Pitting/Scratches/Blue colour → Replace camshaft.
2. Measure:
   - Cam eccentrics
     Out of specification → Replace camshaft.

	(a)	(b)
Intake:	**35.69~35.79 mm**	**30.06~30.16 mm**
Exhaust:	**36.50~36.60 mm**	**30.11~30.21 mm**

3. Measure:
   - Runout (camshaft)
     Out of specification → Replace.

Runout (camshaft):
Less than 0.03 mm

4. Measure:
   - Camshaft-to-cap clearance
     Out of specification → Measure bearing diameter (camshaft).

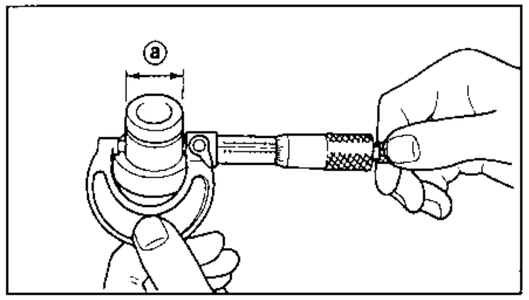
Camshaft-to-cap clearance:
0.020 ~ 0.054 mm

Measurement steps:
- Install the camshaft onto the cylinder head.
- Positione a strip of Plastigauge® onto the camshaft.
- Install the dowel pins and cylinder head cover.

Bolt (cylinder head cover):
10 Nm (1.0 kgm)

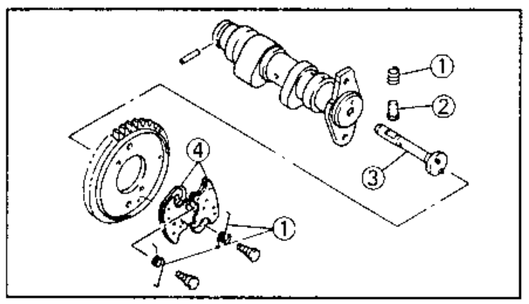
NOTE:
- Tighten the bolts (cylinder head cover) in a criss-cross pattern from innermost to outer.
- Do not turn the camshaft when measuring clearance with the Plastigauge®.

- Remove the cylinder head cover and measure width of the Plastigauge®.



5. Measure:
   - Bearing diameter (a) (camshaft)
     Out of specification → Replace camshaft.
     Within specification → Replace cylinder head.

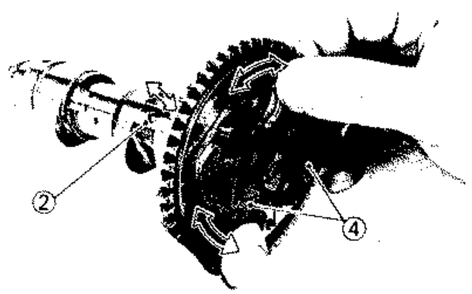
Bearing diameter (camshaft):
22.967 ~ 22.980 mm

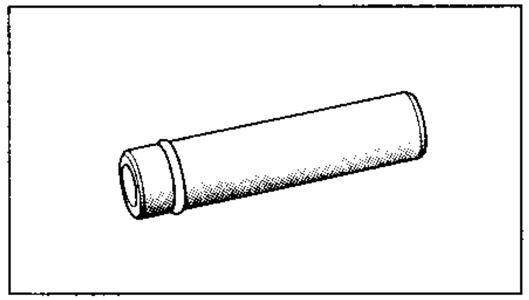


DECOMPRESSION

1. Inspect:
   - Spring (1)
     Damage → Replace.
   - Decompression pin (2)
   - Decompression lever (3)
   - Decompression cams (4)
     Damage/Bends/Wear → Replace.

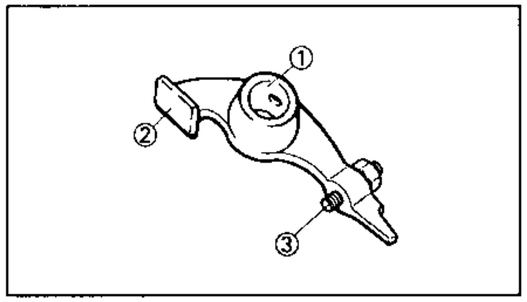
2. Check:
   - Decompression play
     Play exists → Replace.



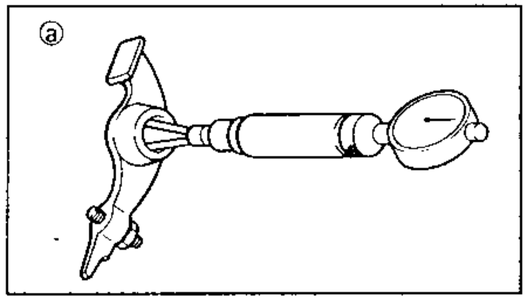


ROCKER ARM AND ROCKER ARM SHAFT

1. Inspect:
   - Rocker arm shaft
     Blue colour/Grooves → Replace shaft and check lubrication system.



2. Inspect:
   - Rocker arm shaft slot (1)
   - Surface in contact with cam eccentric (2)
   - Adjuster surface (3)
     Pitting/Wear/Scratches/Blue colour → Replace and check lubrication system.

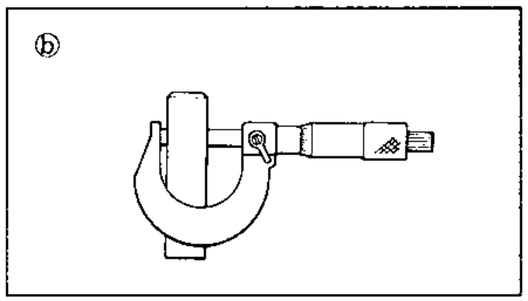


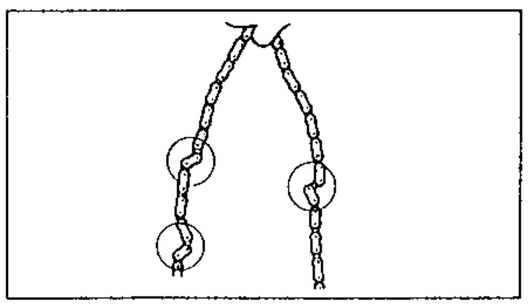
3. Measure:
   - Rocker arm-shaft clearance

Rocker arm-shaft clearance =
Internal diameter (a) of rocker arm – External diameter (b) of shaft

Out of specification → Replace assembly.

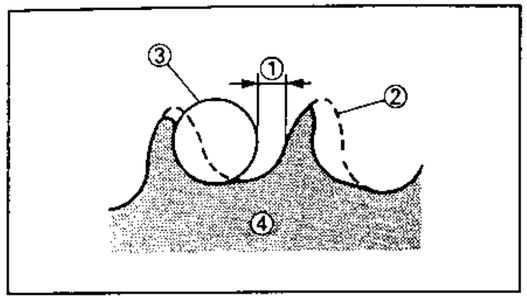
Rocker arm shaft clearance:
0.009 ~ 0.042 mm





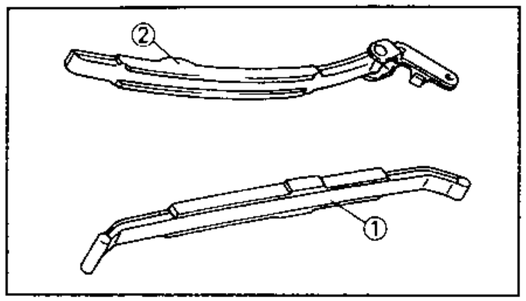
CAMSHAFT CHAIN, SPROCKET AND CHAIN GUIDE

1. Inspect:
   - Chain
     Stiffness/Cracks → Replace timing chain and sprocket.



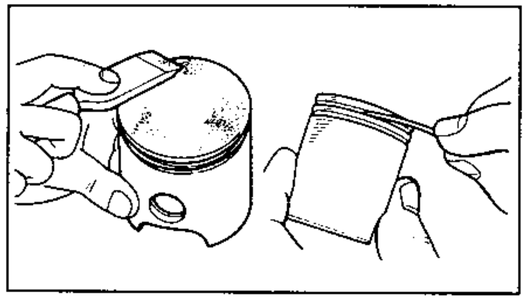
2. Inspect:
   - Sprocket
     Wear/Damage → Replace timing chain and sprocket.

(1) 1/4 tooth (maximum)
(2) New sprocket tooth profile
(3) Roller
(4) Sprocket



CAMSHAFT CHAIN GUIDE

1. Inspect:
   - Lateral chain guide (exhaust) (1)
   - Lateral chain guide (intake) (2)
     Wear/Damage → Replace.

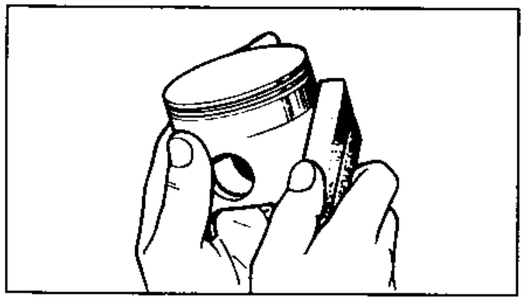


CYLINDER AND PISTON

1. Eliminate:
   - Carbon deposits
     (from the piston crow and ring grooves)

2. Inspect:
   - Piston wall
     Wear/Scratches/Damage → Replace.

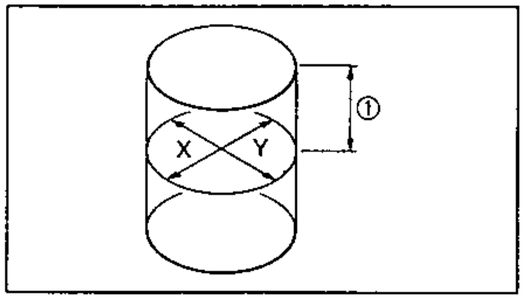
3. Eliminate:
   - Score marks and lacquer deposits
     (from the side of the piston)
     Use a 600 ~ 800 grit wet sandpaper.



NOTE:
Sand in a crisscross pattern. Do not sand excessively.

4. Inspect:
   - Cylinder water jacket
     Crust of minerals/Rust → Remove.
   - Cylinder wall
     Wear/Scratches → Rebore or replace.

5. Measure:
   - Piston-to-cylinder clearance



Measurement stages:

First stage

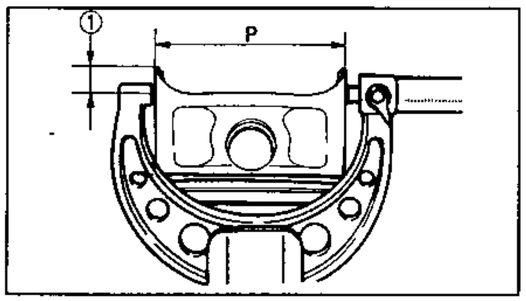
- Measure cylinder bore "C" with a cylinder gauge.

(1) 50 mm from top of cylinder

NOTE:
Measure bore parallel and at right angles to the driving shaft. Then calculate average measurement.

	Standard	Wear limit
Cylinder bore "C"	100.005 ~ 100.045 mm	100.1 mm
$C = \frac{X + Y}{2}$		

- If the measurements are out of tolerance, replace the cylinder liner, piston and circlips all together.



Second stage

- Measure diameter "P" of the piston skirt with a micrometer.

(1) 2.5 mm from the lower edge of the piston

Piston skirt "P" size:	
Standard	99.945 ~ 99.985 mm

- If the measurements are out of tolerance, replace the piston and circlips all together.

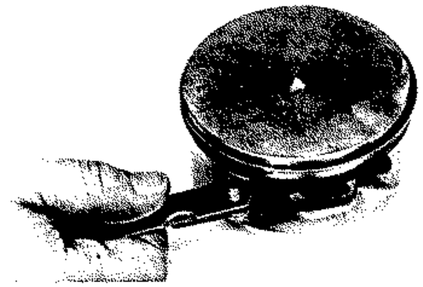
Third stage

- Calculate the piston-cylinder clearance according to the following formula.

Piston-cylinder clearance =
Cylinder boring "C" – Piston skirt diameter "P"

Piston-cylinder clearance:
0.050 ~ 0.070 mm
Maximum limit:
0.15 mm

- If the measurements are out of tolerance, rebore or replace the cylinder, and replace the piston and piston ring as a set.

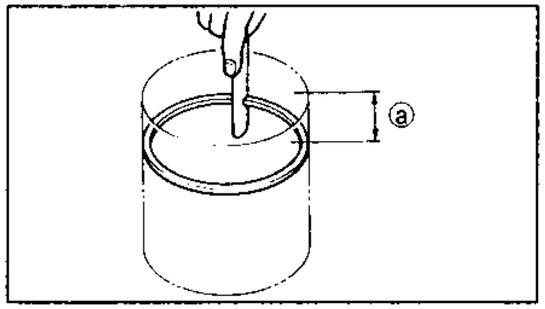


PISTON RINGS

1. Measure:
   - Lateral clearance of rings
     Use a thickness gauge.
     Out of specification → Replace piston and piston ring as a set.

NOTE:
Before measuring lateral clearance, remove carbon deposits from the piston ring seats and from the rings themselves.

Piston ring lateral clearance:	
Upper ring	0.04 ~ 0.08 mm
Lower ring	0.03 ~ 0.07 mm



2. Position:
   - Ring
     (into cylinder)

NOTE:
Fit each ring into the cylinder and push it to about 20 mm from the top edge of the cylinder. Push the ring into the cylinder with the piston so that it is perfectly perpendicular to the cylinder axis.

(a) 20 mm

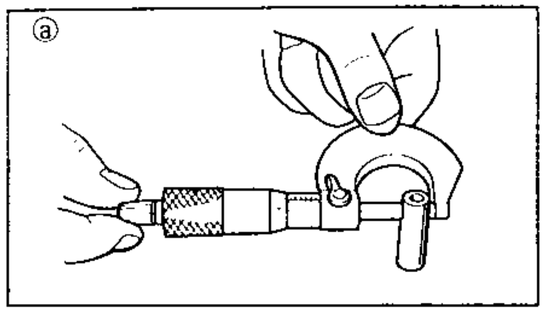
3. Measure:
   - Ring tip port
     Out of specification → Replace.

NOTE:
It is impossible to measure the oil scraper tip port. If the oil scraper port appears too large, replace all three rings as a set.

Piston ring tip port (fitted into cylinder)	
Upper ring	0.30 ~ 0.45 mm
Lower ring	0.30 ~ 0.45 mm
Oil scraper (tracks)	0.20 ~ 0.70 mm

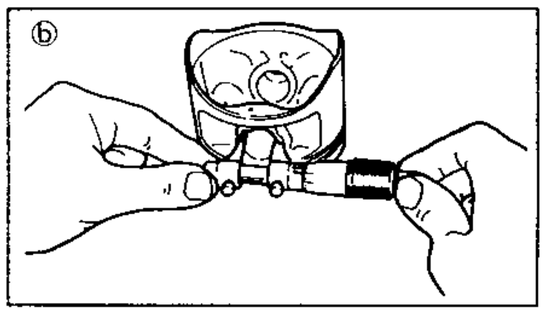
PISTON PIN

1. Check:
   - Piston pin
     Blue colour/Grooves → Replace and check lubrication system.



2. Measure:
   - External diameter (a) of pin
     Out of specification → Replace.

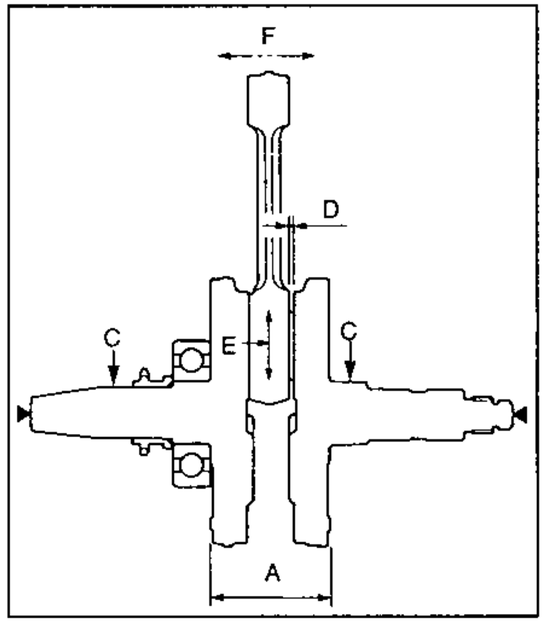
External diameter (pin):
21.991 ~ 22.000 mm



3. Measure:
   - Clearance between piston pin and piston pin seat
     Out of specification → Replace.
   - Calculate the piston pin–piston clearance according to the following formula:

Clearance between piston pin and piston =
Diameter on piston (b) –
Diameter of pin (a)

Clearance between piston pin and piston:
0.004 ~ 0.024 mm
Maximum clearance:
0.07 mm



CRANKSHAFT

1. Measure:
   - Crank width (A)
     Out of specification → Replace crankshaft.

Crank width:
74.95 ~ 75.00 mm

   - Runout (C)
     Out of specification → Replace crankshaft and/or width bearing.

Runout limit:
0.03 mm

   - Small end free play (D)
     Out of specification → Replace big end bearing, crank pin and/or connecting rod.

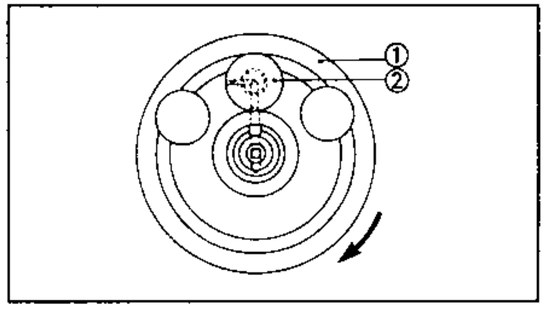
Small end free play:
0.8 mm

   - Big end radial clearance (E)
     Out of specification → Replace connecting rod, big end bearing and/or crank pin.

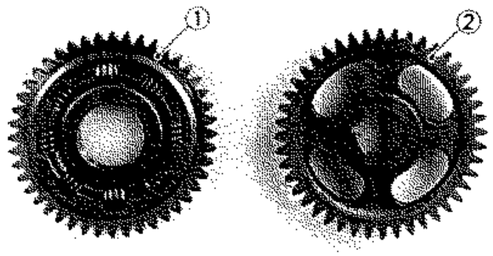
Big end radial clearance:
0.01 ~ 0.025 mm

   - Side clearance (F)
     Out of specification → Replace connecting rod.

Big end side clearance:
0.35 ~ 0.65 mm

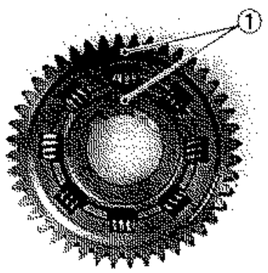


Crankshaft reassembling point:
The crankshaft (1) and the crank pin (2) oil passages must be properly interconnected with a tolerance of less than 1.0 mm.

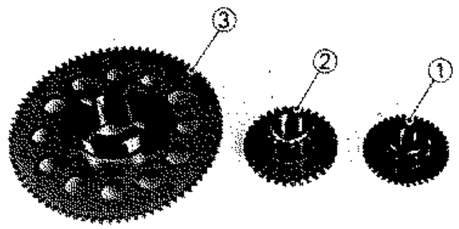


BALANCER DRIVE GEAR AND BALANCER GEAR

1. Inspect:
   - Balancer drive gear teeth (1)
   - Balancer gear teeth (2)
     Wear/Damage → Replace both gears.

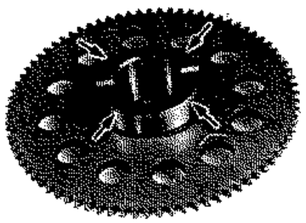


2. Check:
   - Match marks (1)
     If they are not aligned → Align match marks as shown.

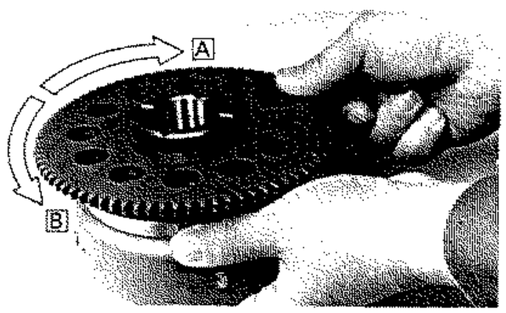


ELECTRIC STARTER DRIVE

1. Inspect:
   - Starter idle gear 1 teeth (1)
   - Starter idle gear 2 teeth (2)
   - Starter wheel gear teeth (3)
     Burrs/Chips/Roughness/Wear → Replace.



2. Inspect:
   - Starter wheel gear
     (contacting surfaces)
     Pitting/Wear/Damage → Replace.

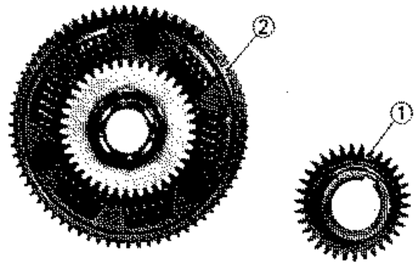


3. Check:
   - Starter clutch operation

Checking steps:

- Install the starter wheel gear to the starter clutch, and hold the starter clutch.

- When turning the starter wheel gear clockwise [A], the starter clutch and the wheel gear should be engaged.
  If not, the starter clutch is faulty. Replace it.
- When turning the starter wheel gear counter-clockwise [B], the starter clutch gear should turn freely.
  If not, the starter clutch is faulty. Replace it.

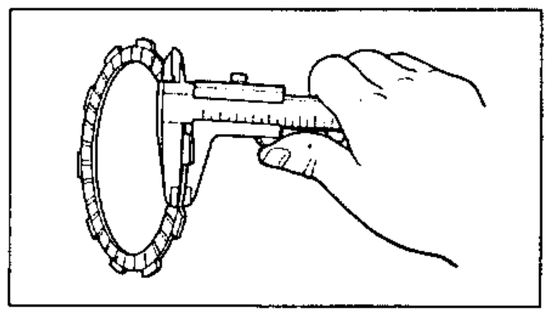


PRIMARY DRIVE

1. Inspect:
   - Primary drive gear teeth (1)
   - Primary driven gear teeth (2)
     Wear/Damage → Replace both gears.
     Excessive noises during operation → Replace both gears.

CLUTCH

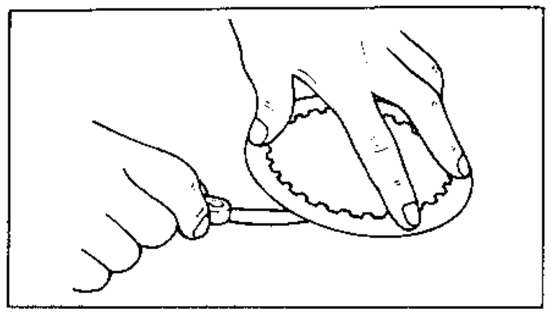
1. Inspect:
   - Friction plates
     Damage → Replace friction plate as a set.



2. Measure:
   - Friction plate thickness
     Out of specification → Replace friction plate as a set.
     Measure at all four points.

	Thickness	Wear limit
Type "A" (2 pcs.)	2.94 ~ 3.06 mm	2.8 mm
Type "B" (6 pcs.)	2.74 ~ 2,86 mm	2.6 mm

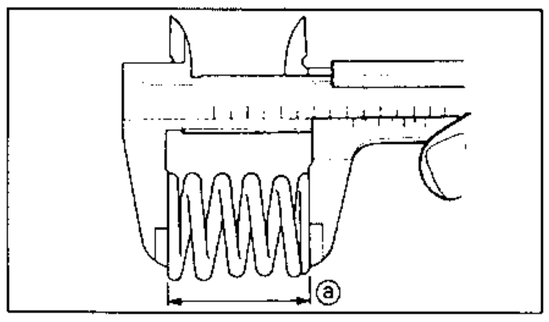
3. Inspect:
   - Clutch plates
     Damage → Replace clutch plates as a set.



4. Measure:
   - Clutch plate warpage
     Out of specification → Replace clutch plate as a set.
     Use a surface plate and feeler gauge.

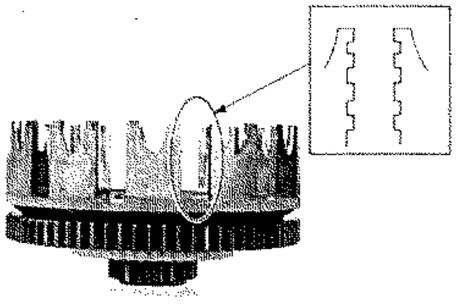
Clutch plate warp limit:
Less than 0.2 mm

5. Inspect:
   - Clutch springs
     Damage → Replace springs as a set.



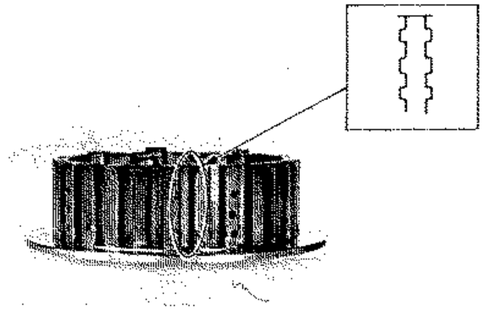
6. Measure:
   - Clutch spring free length (a)
     Out of specification → Replace springs as a set.

Free length (clutch spring):
42.8 mm
< Limit: 40.8 mm >



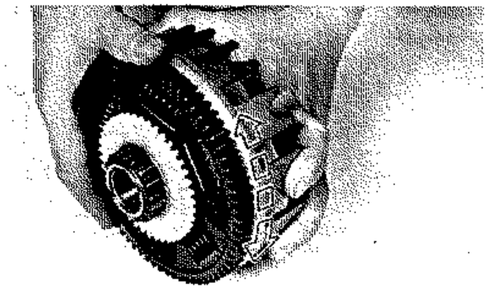
7. Inspect:
   - Dogs on the clutch housing
     Scoring/Wear/Damage (on edges):
     Moderate → Deburr.
     Accentuated → Replace clutch housing.

NOTE:
Scoring on the clutch housing dogs will cause erratic operation.

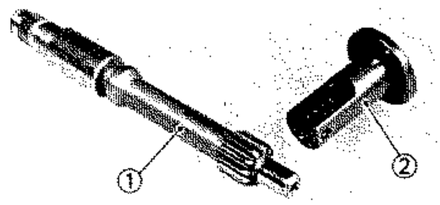


8. Inspect:
   - Clutch boss splines
     Scoring:
     Moderate → Deburr.
     Accentuated → Replace clutch boss.

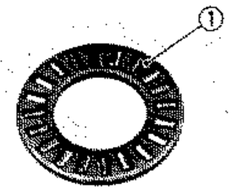
NOTE:
Scoring on the clutch boss splines will cause erratic operation.



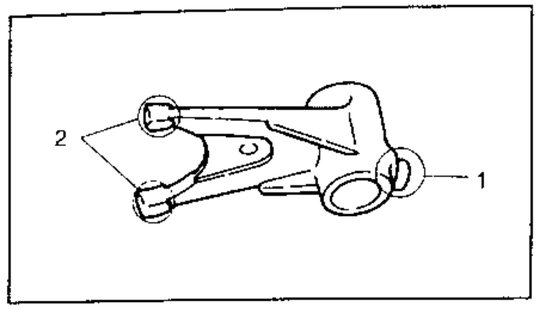
9. Check:
   - Circumferential play
     Free play exists → Replace.



10. Inspect:
    - Gear teeth (1) (pull lever axle)
    - Gear teeth (2) (pull rod)
      Wear/Damage → Replace as a set.

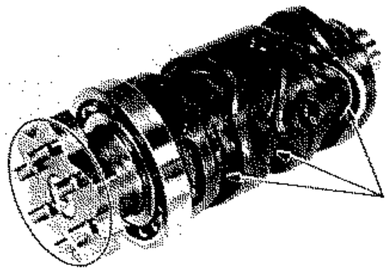


11. Inspect:
    - Bearing (1) (pull rod)
      Wear/Damage → Replace.

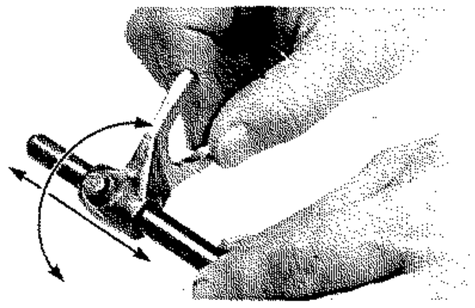


TRANSMISSION AND GEARBOX

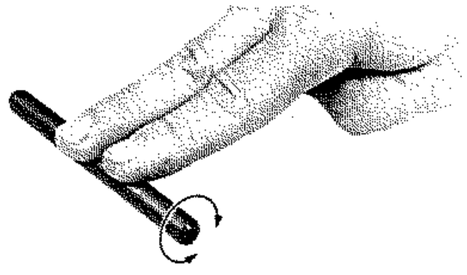
1. Inspect:
   - Gear fork cam pin (1)
   - Gear fork pawl (2)
     Lines/Creases/Wear → Replace.



2. Inspect:
   - Drum groove
   - Gear cam pins
     Wear/Damage → Replace.



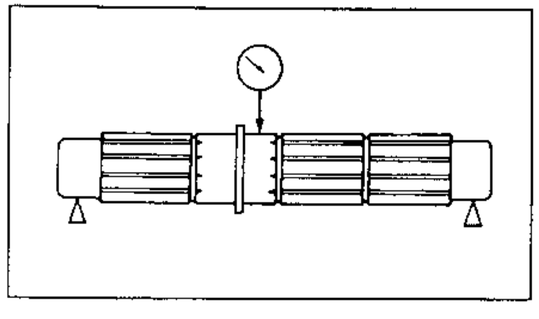
3. Check:
   - Gear fork movement
     Rough functioning → Replace gear forks and/or guide bars.



4. Inspect:
   - Guide bar
     Turn on a flat surface
     Curvature → Replace.

⚠ WARNING

Do not attempt to straighten a deformed guide bar.

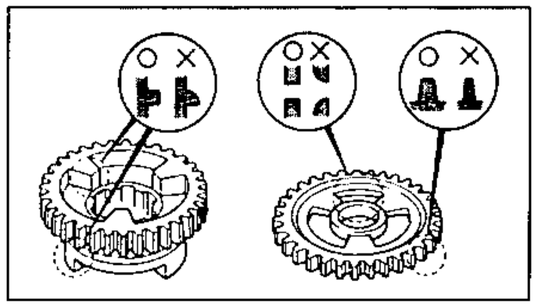


5. Measure:
   - Transmission shaft eccentricity.
     Use the centring tool and micrometer.
     Out of specification → Replace shaft.

Eccentricity limit:
0.08 mm

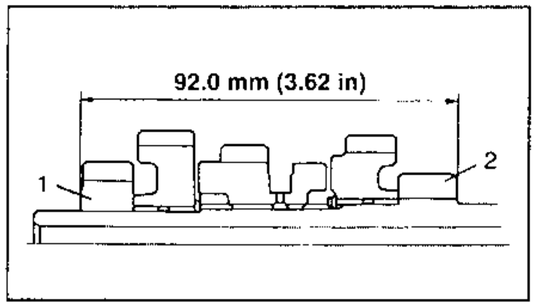
⚠ WARNING

Do not attempt to straighten a deformed shaft.



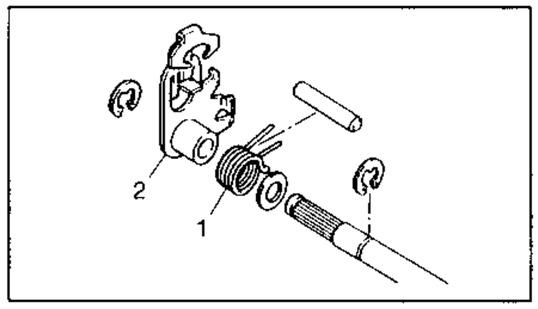
6. Inspect:
   - Gear teeth
     Brown colouring/Pitting/Wear → Replace.
   - Mating clutches
     Rounded edges/Cracks/Missing fragments → Replace.

7. Check:
   - Proper mating of each gear (with corresponding part)
   - Gear movement
     Roughness → Replace.



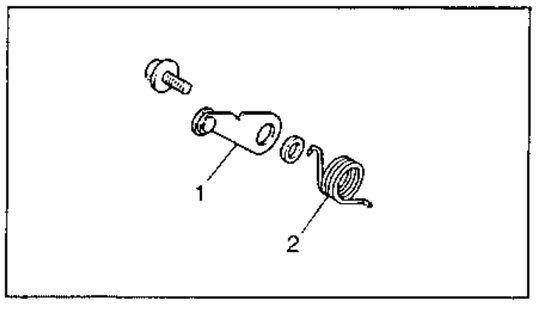
Transmission gear assembly stages:

- Fit the 2nd pinion gear (1) to the propeller shaft (2) as shown in the figure.

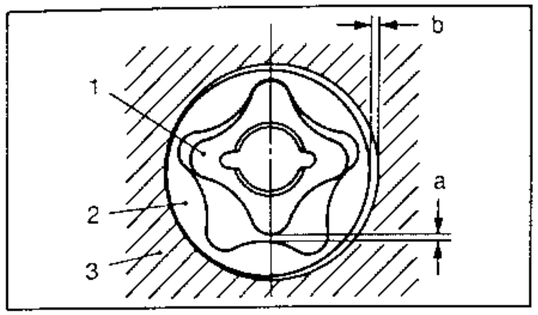


8. Inspect:
   - Spring (1)
     Damage → Replace.
   - Shift lever (2)
     Damage/Bends/Wear → Replace.

9. Inspect
   - Shift shaft:
     Bent/Wear/Damage → Replace.



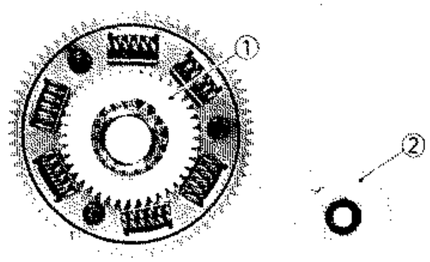
10. Inspect:
    - Stop lever (1)
      The roller rotates jerkily → Replace.
      Bent/Damage → Replace.
    - Return spring (2)
      Damage/Cracks → Replace.



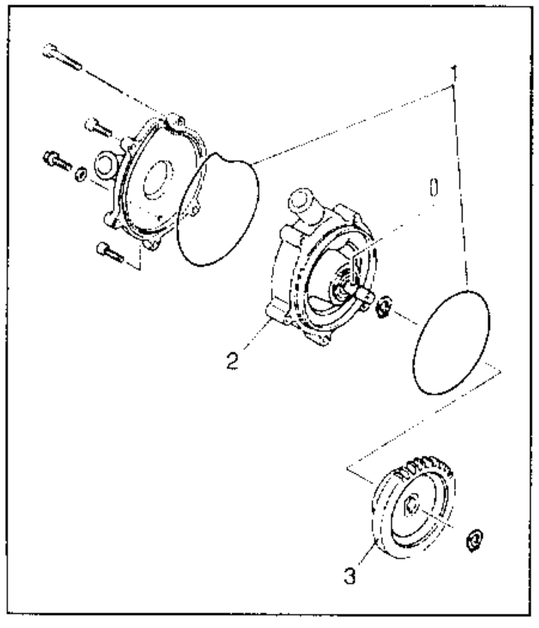
OIL PUMP, WATER PUMP AND STRAINER

1. Measure:
   - Clearance between rotors (a)
     Between the internal rotor (1) and the external rotor (2)
   - Lateral clearance (b)
     Between the external rotor (2) and the pump stator (3)
     Out of specification → Replace oil pump.

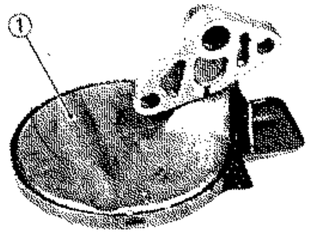
Oil pump clearances:	
Clearance between rotors (a)	0.12 mm
Lateral clearance (b)	0.03 ~ 0.08 mm



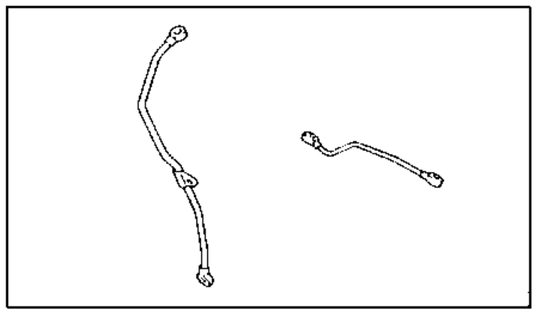
2. Inspect:
   - Oil pump drive gear (1)
   - Oil pump driven gear (2)
     Wear/Cracks/Damage → Replace.



3. Inspect:
   - O-ring (1)
   - Water pump housing (2)
   - Water pump gear (3)
     Cracks/Wear/Damage → Replace.



4. Inspect:
   - Oil strainer (1)
     Damage → Replace.



OIL DELIVERY PIPES

1. Inspect:
   - Oil delivery pipes
     Cracks/Damages → Replace.
     Clog → Blow out with compressed air.

CRANKCASE

1. Thoroughly wash the case halves in mild solvent.
2. Clean all the gasket mating surface and crankcase mating surface thoroughly.
3. Inspect:
   - Crankcase
     Cracks/Damage → Replace.
   - Oil delivery passages
     Clog → Blow out whit compressed air.

BEARING AND OIL SEAL

1. Inspect:
   - Bearing
     Clean and lubricate, then rotate inner race with finger.
     Roughness → Replace.
2. Inspect:
   - Oil seal
     Damage/Wear → Replace.

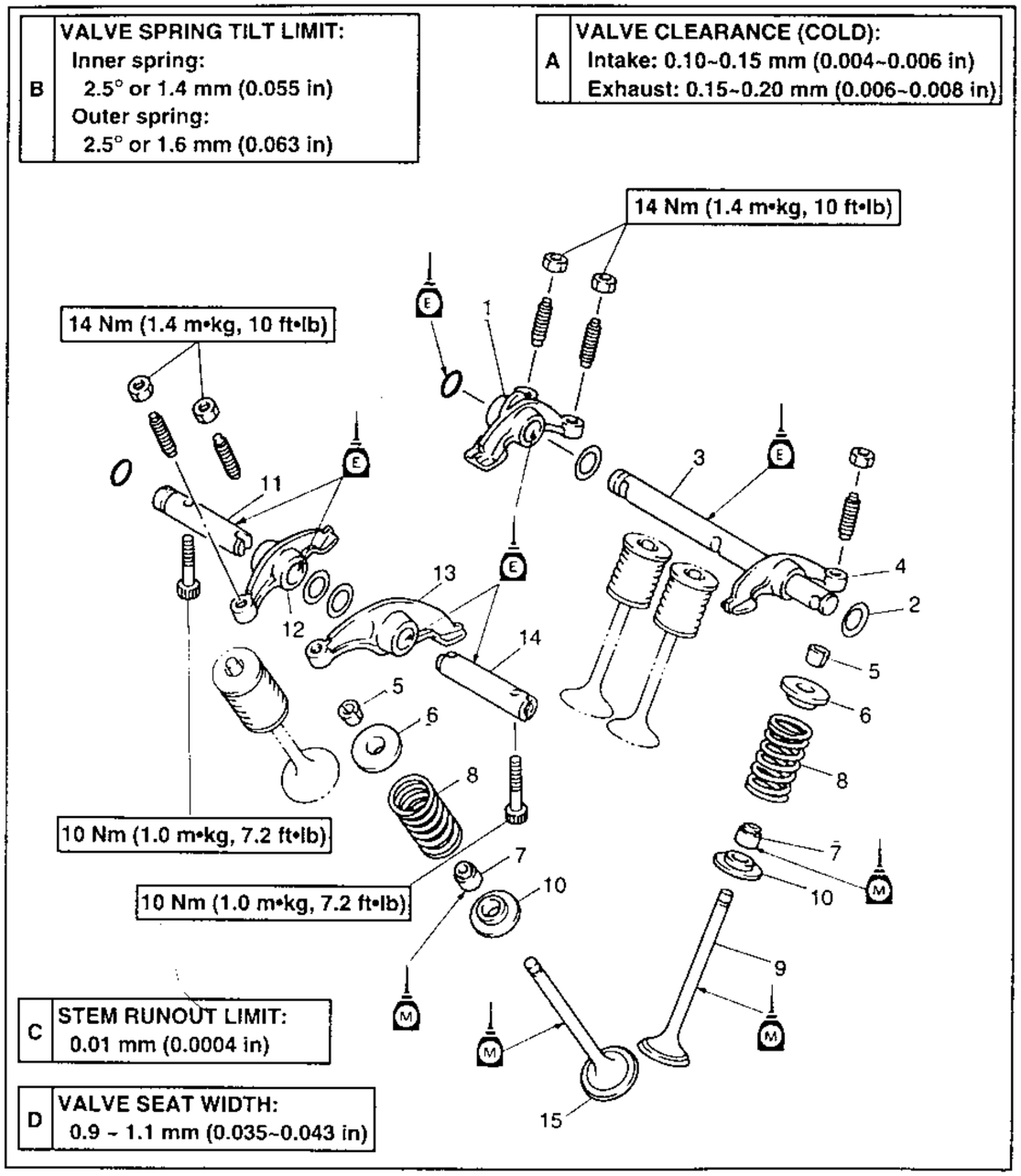
CIRCLIP AND WASHER

1. Inspect:
   - Circlip
   - Washer
     Damage/Free play/Warp → Replace.

ENGINE ASSEMBLY AND SETTING

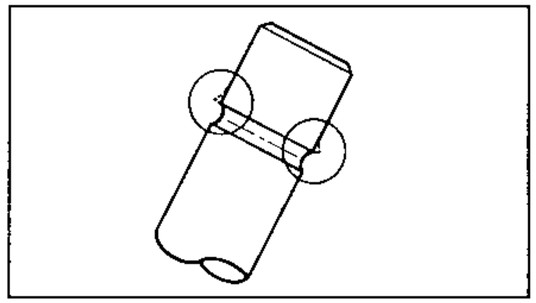
VALVES AND ROCKER ARMS

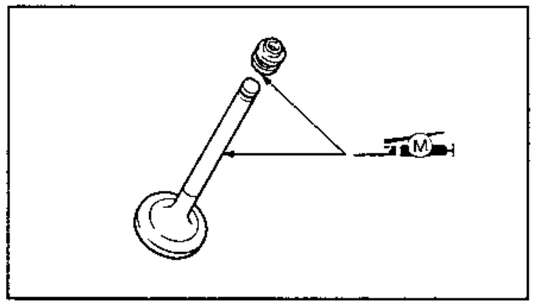
(1) Rocker arm n. 2
(2) Wave washer
(3) Rocker shaft (intake)
(4) Rocker arm n. 1
(5) Valve cotters
(6) Upper valve spring retainer
(7) Oil seal
(8) Valve spring
(9) Valve (intake)
(10) Lower valve spring retainer
(11) Rocker shaft (exhaust)
(12) Rocker arm n. 4
(13) Rocker arm n. 3
(14) Rocker shaft (exhaust)
(15) Valve (exhaust)

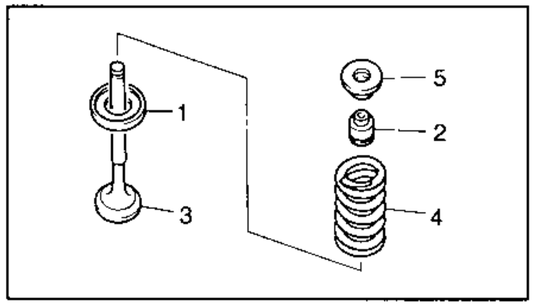

B VALVE SPRING TILT LIMIT:
Inner spring:
2.5° or 1.4 mm (0.055 in)
Outer spring:
2.5° or 1.6 mm (0.063 in)
A VALVE CLEARANCE (COLD):
Intake: 0.10~0.15 mm (0.004~0.006 in)
Exhaust: 0.15~0.20 mm (0.006~0.008 in)
14 Nm (1.4 m•kg, 10 ft•lb)
14 Nm (1.4 m•kg, 10 ft•lb)
10 Nm (1.0 m•kg, 7.2 ft•lb)
10 Nm (1.0 m•kg, 7.2 ft•lb)
C STEM RUNOUT LIMIT:
0.01 mm (0.0004 in)
D VALVE SEAT WIDTH:
0.9 ~ 1.1 mm (0.035~0.043 in)

⚠ WARNING

For engine reassembly, replace the following parts whit new one.
- **O-ring**
- **Gasket**
- **Oil seal**
- **Key**
- **Lock washer**
- **Circlip**





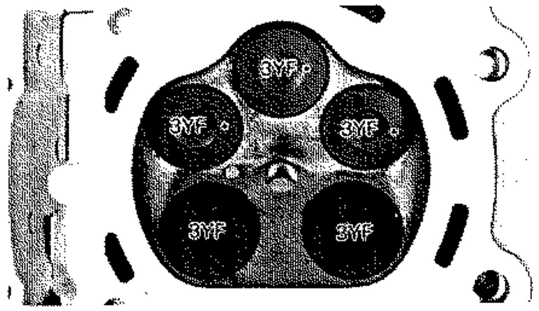


VALVES

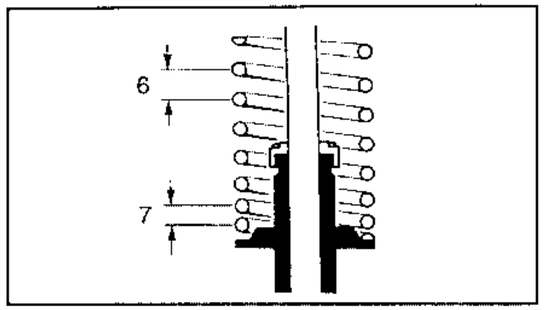
1. Burrs:
   - Valve stem head
     Polish the valve stem head with an oil stone.

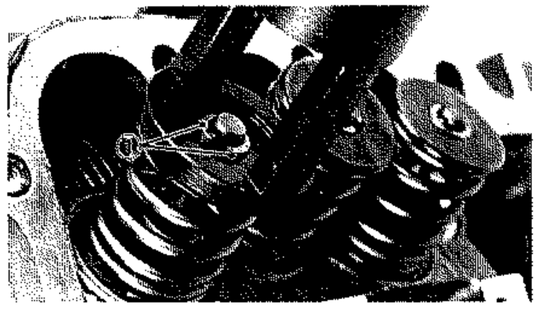
2. Apply:
   - Molybdenum disulfide grease (to the valve stem and oil seal)

3. Install:
   - Lower valve cap (1)
   - Oil seal (2)
   - Valve (3)
   - Valve spring (4)
   - Upper valve cap (5) (into cylinder head)



NOTE:
- Make sure that the each valve is installed in its original place by reference to it embossed identification mark, as follows:
  Intake: 3YF ●
  Exhaust: 3YF
- Install the valve spring with larger pitch (6) facing upward.
  (7) Smaller pitch.





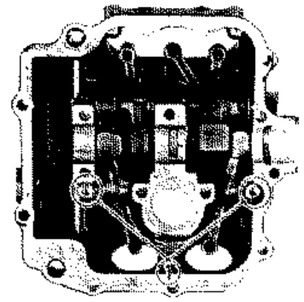
4. Install:
   - Valve cotters (1)

NOTE:
Install the valve cotters while compressing the valve spring with the valve spring compressor.

	Valve spring compressor: **P/N YM-04019, 90890-04019**

5. Secure the valve cotters on to the valve stem by tapping it lightly with a piece of wood.

CAUTION:
Do not hit so much as to damage the valve.



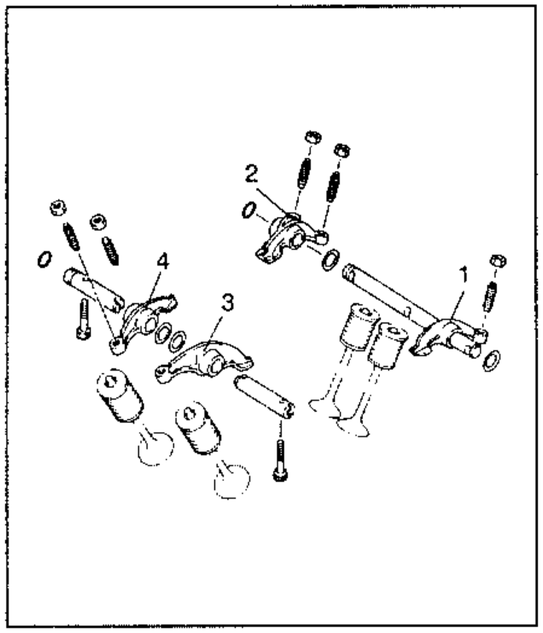
ROCKER ARMS

1. Lubricate:
   - Rocker shaft
     (with engine oil)

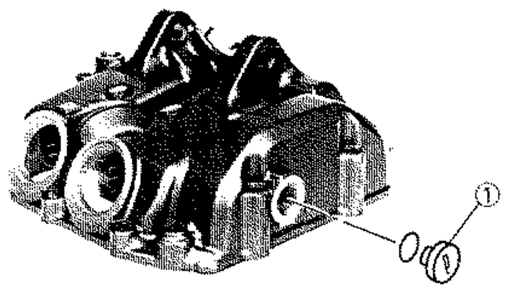
2. Install:
   - Rocker arm
   - Rocker shaft

	Screws (1) (rocker shaft): **10 Nm (1.0 mkg)**

NOTE:
Each rocker arm is numbered.



(1) # 1
(2) # 2
(3) # 3
(4) # 4

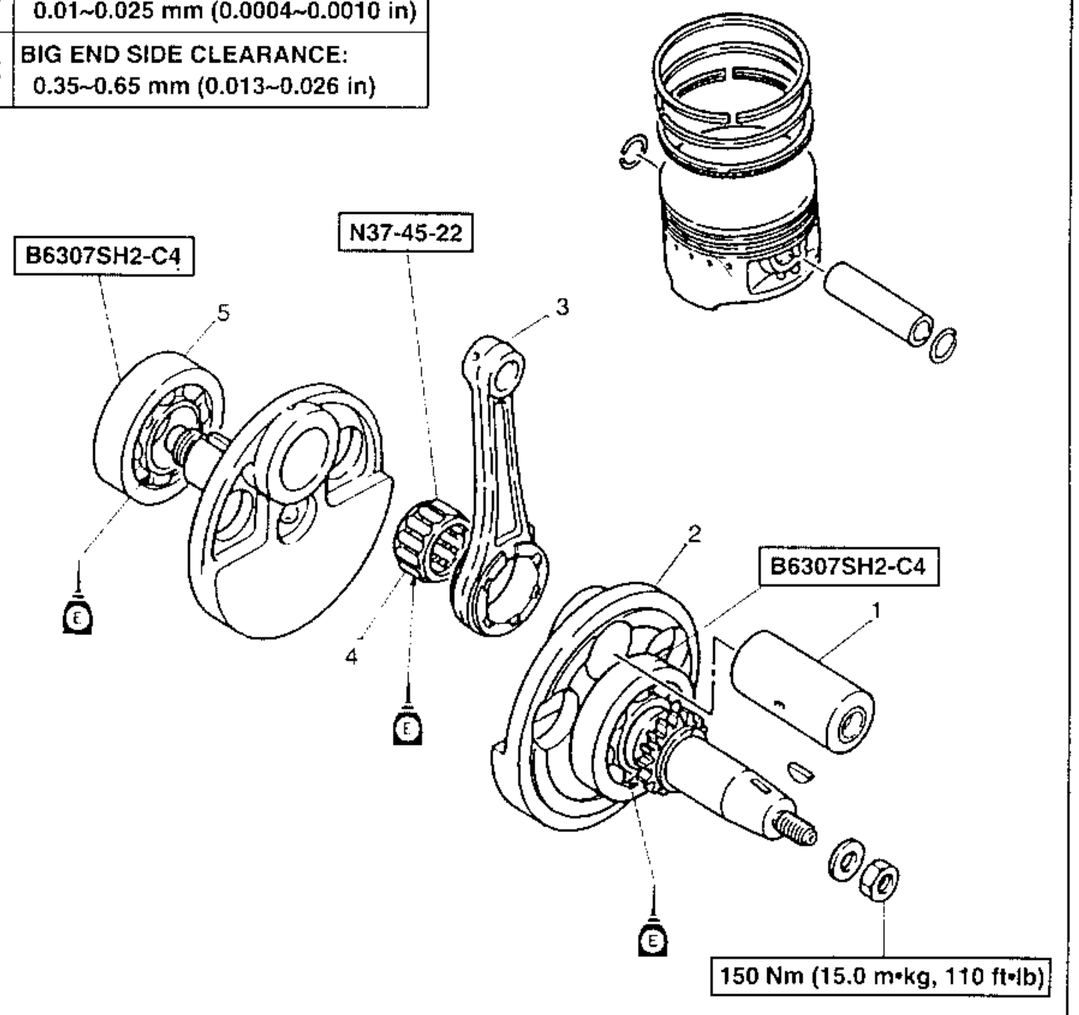


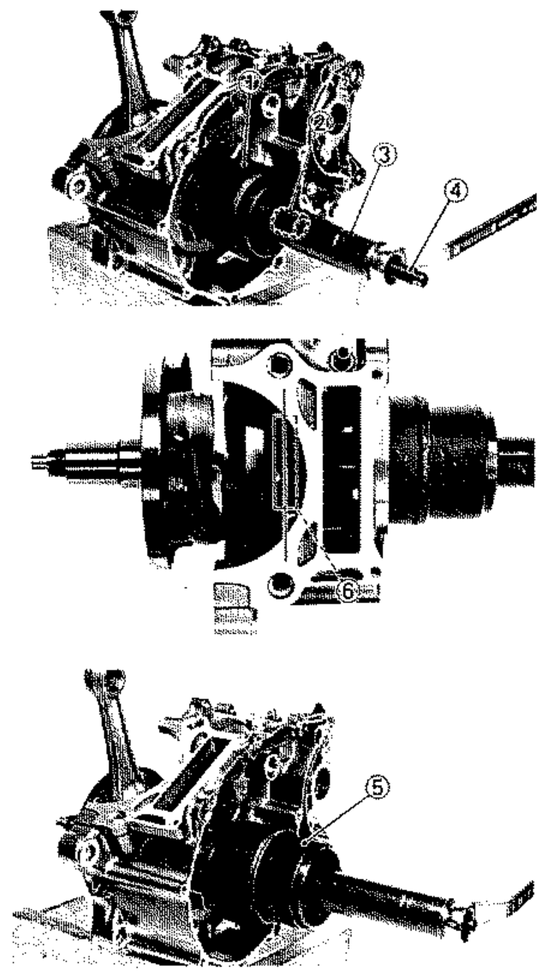
3. Install:
   - Cap (1)

CRANKSHAFT

(1) Connecting rod pin
(2) Crank (left)
(3) Connecting rod
(4) Bearing
(5) Bearing

A	CRANK WIDTH: 74.95~75.00 mm (2.950~2.953 in)
B	RUNOUT LIMIT: 0.03 mm (0.0012 in)
C	SMALL END FREE PLAY: 0.8 mm (0.031 in)
D	BIG END RADIAL CLEARANCE: 0.01~0.025 mm (0.0004~0.0010 in)
E	BIG END SIDE CLEARANCE: 0.35~0.65 mm (0.013~0.026 in)





1. Attach:
   - Crankshaft installing tool

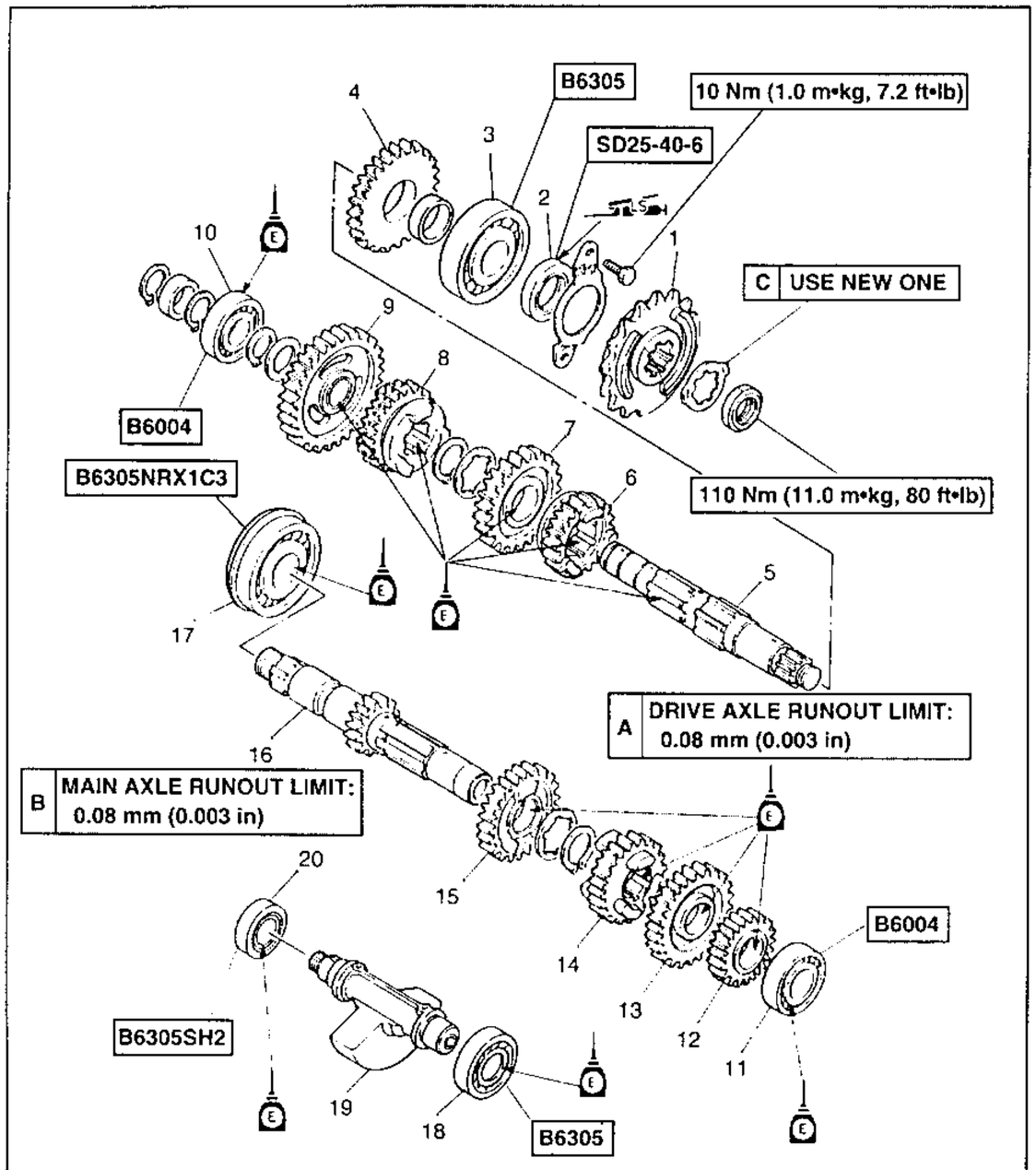
Crankshaft installer set:
P/N. YU-90050
Crank pot spacer (1):
P/N. YM-91044
P/N. 90890-04081
Adapter # 10 (2):
P/N. YM-90069
P/N. 90890-04059
Crankshaft installer pot (3):
P/N. 90890-01274
Crankshaft installer bolt (4):
P/N. 90890-01275
Spacer (5):
P/N. 90890-01288

NOTE:
Hold the connecting rod at top dead center with one hand while turning the nut of the installing tool with the other. Operate the installing tool until half of the crankshaft bearing (6) is inserted into the crankcase as shown. Then, add the spacer (5) as shown and operate the installing tool until the crankshaft bottoms against the bearing.

CAUTION:
To protect the crankshaft against scratches or to facilitate the operation of the installation apply the grease to the oil seal lips, and apply the engine oil to each bearing.

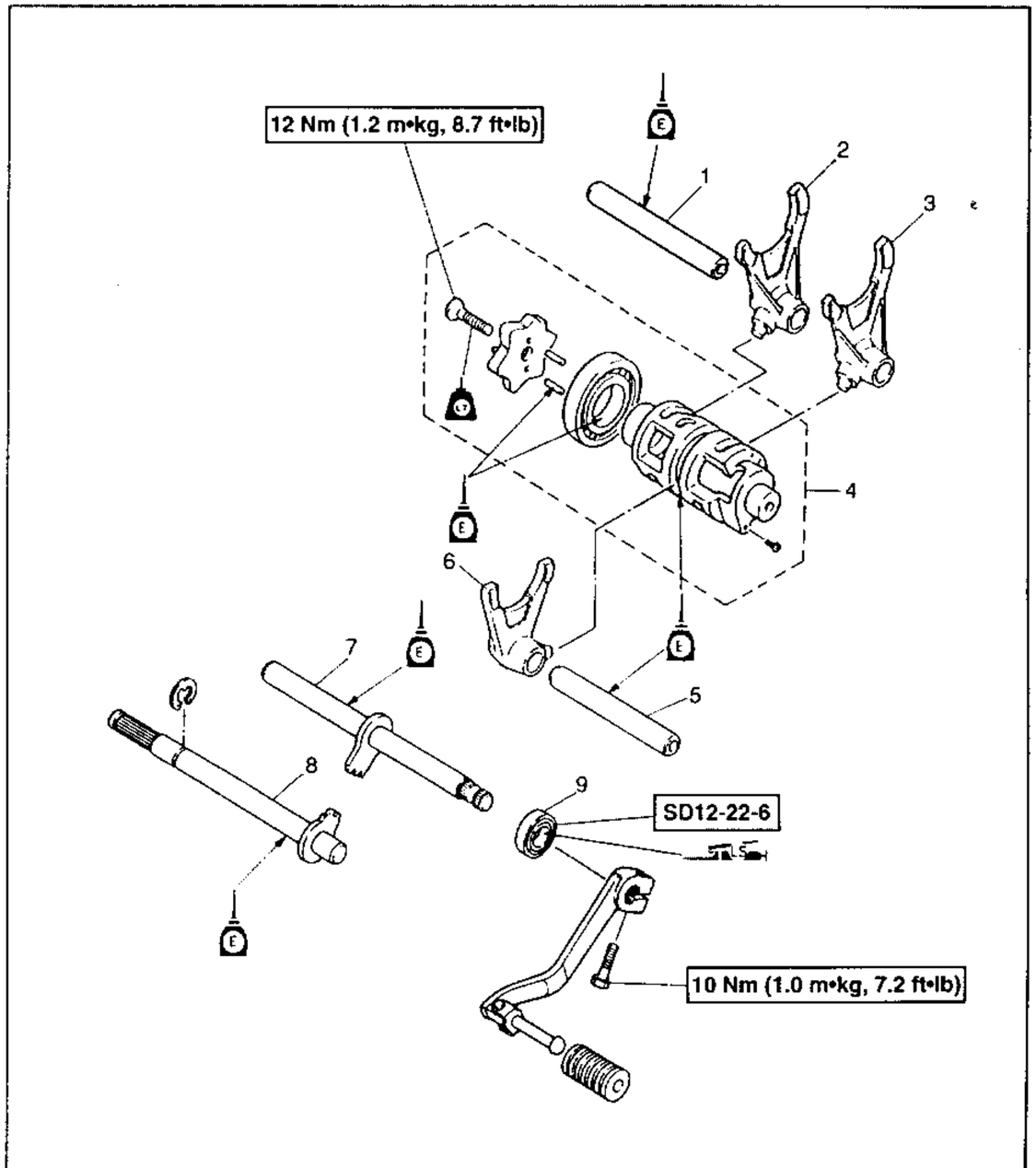
BALANCER SHAFT AND TRANSMISSION

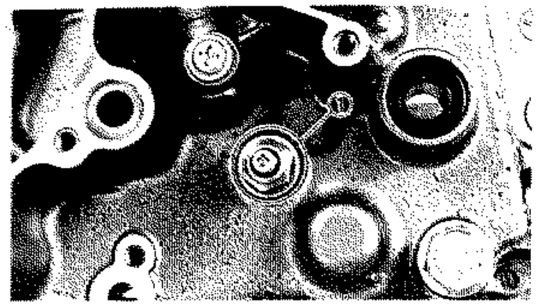
(1) Sprocket
(2) Oil seal
(3) Bearing
(4) Second wheel gear
(5) Secondary shaft
(6) Fifth wheel gear
(7) Third wheel gear
(8) Fourth wheel gear
(9) First wheel gear
(10) Bearing
(11) Bearing
(12) Second sprocket gear
(13) Fifth sprocket gear
(14) Third sprocket gear
(15) Fourth sprocket gear
(16) Main shaft
(17) Bearing
(18) Bearing
(19) Bearing
(20) Bearing



SHIFTER

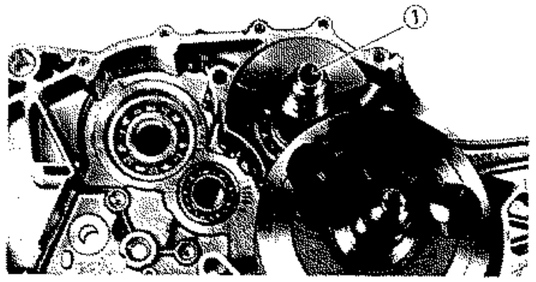
(1) Guide bar (long)
(2) Selector fork #3 "R"
(3) Selector fork #1 "L"
(4) Gear cam
(5) Guide bar (short)
(6) Selector fork #2 "C"
(7) Gear shaft #2
(8) Gear shaft #1
(9) Oil seal



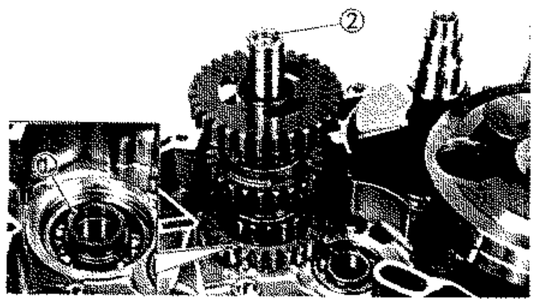


BALANCER, TRANSMISSION AND SHIFTER

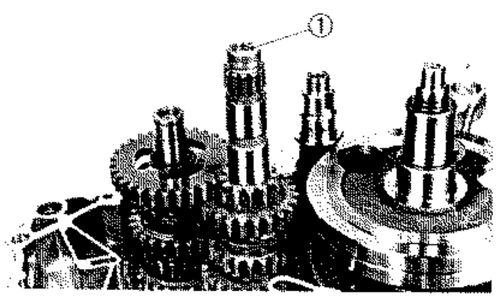
1. Install:
   - Neutral switch (1)



2. Install:
   - Balancer shaft (1)

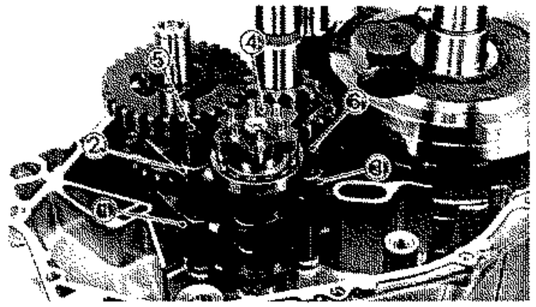


3. Install:
   - Collar (1)
   - Drive axle assembly (2)



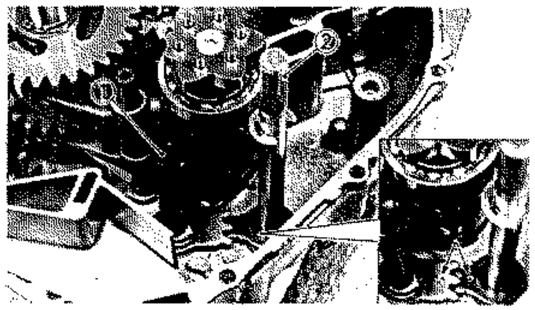
4. Install:
   - Main axle assembly (1)

5. Apply:
   - Engine oil
     (onto guide bars)

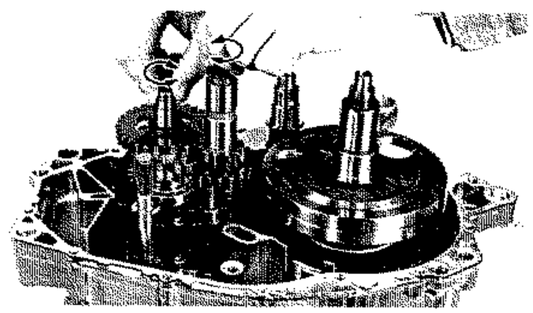


6. Install:
   - Shift fork #1 "L" (1)
   - Shift fork #3 "R" (2)
   - Shift fork #2 "C" (3)
   - Gear cam (4)
   - Guide bar (long) (5)
   - Guide bar (short) (6)

NOTE:
Install the shift forks with the embossed mark on each shift fork facing right side of the engine.



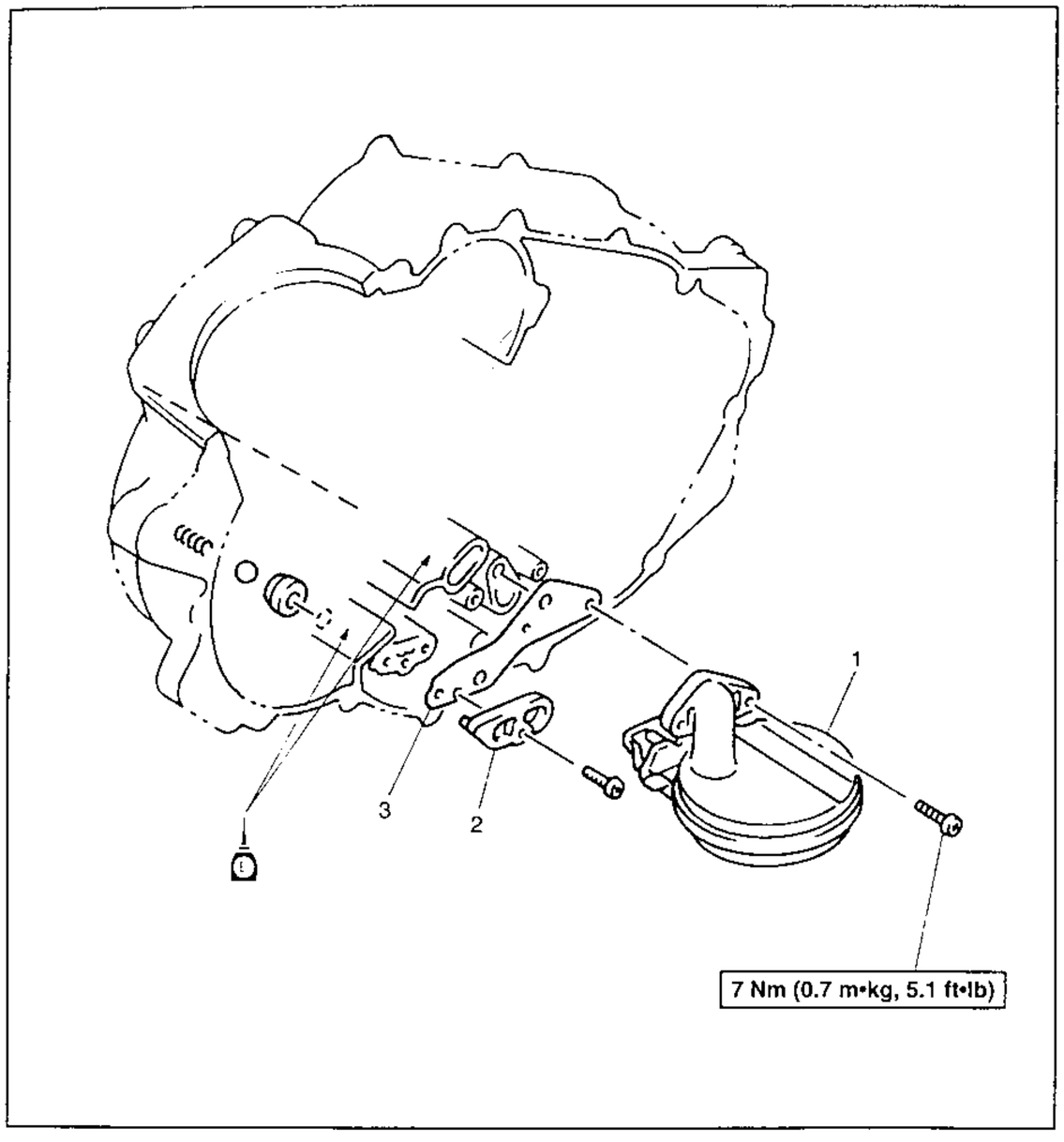
7. Install:
   - Shift shaft #2 (1)
   - Shift shaft #1 (2)



8. Check:
   - Transmission operation
     Unsmooth operation → Repair.

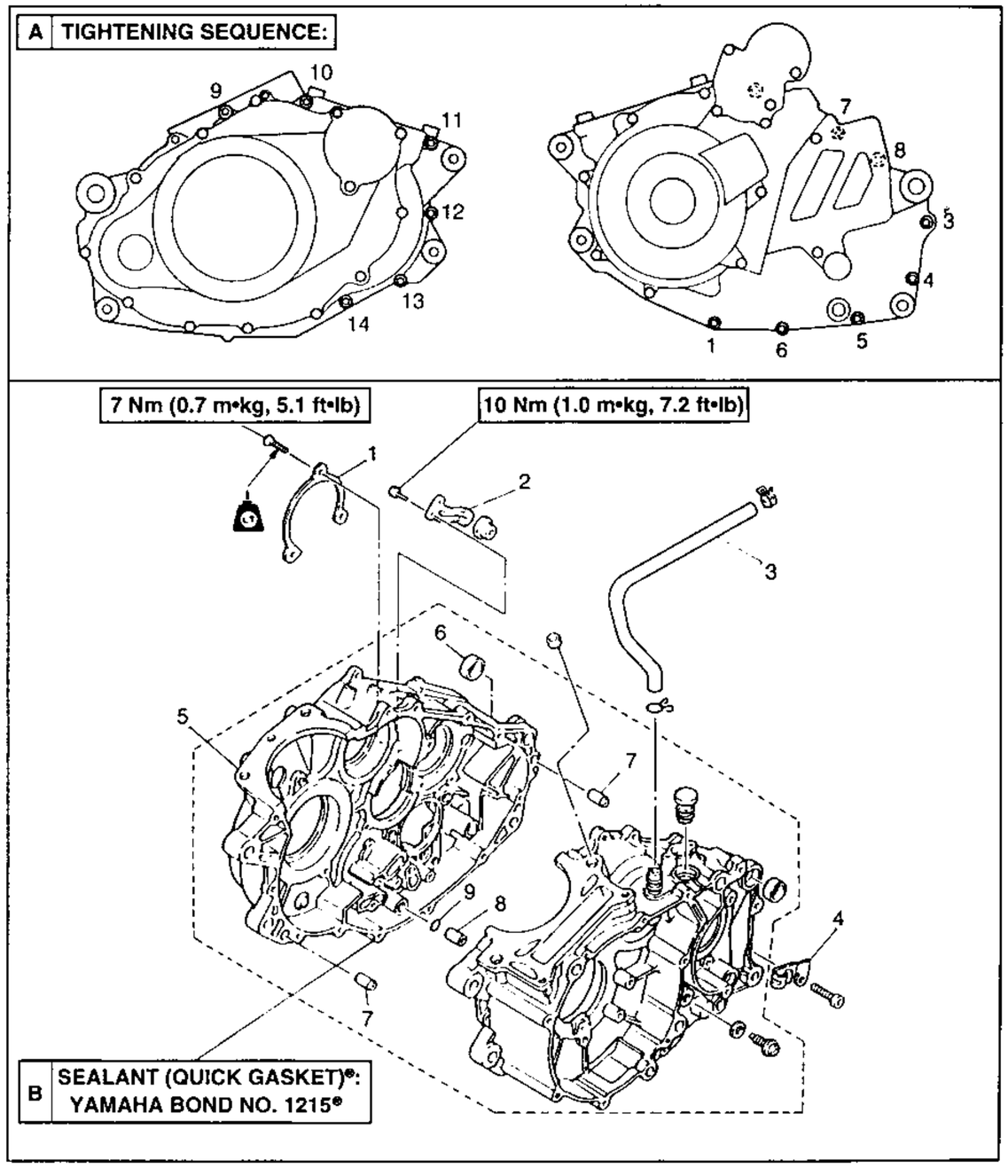
OIL STRAINER

(1) Oil strainer
(2) Oil duct oil
(3) Gasket



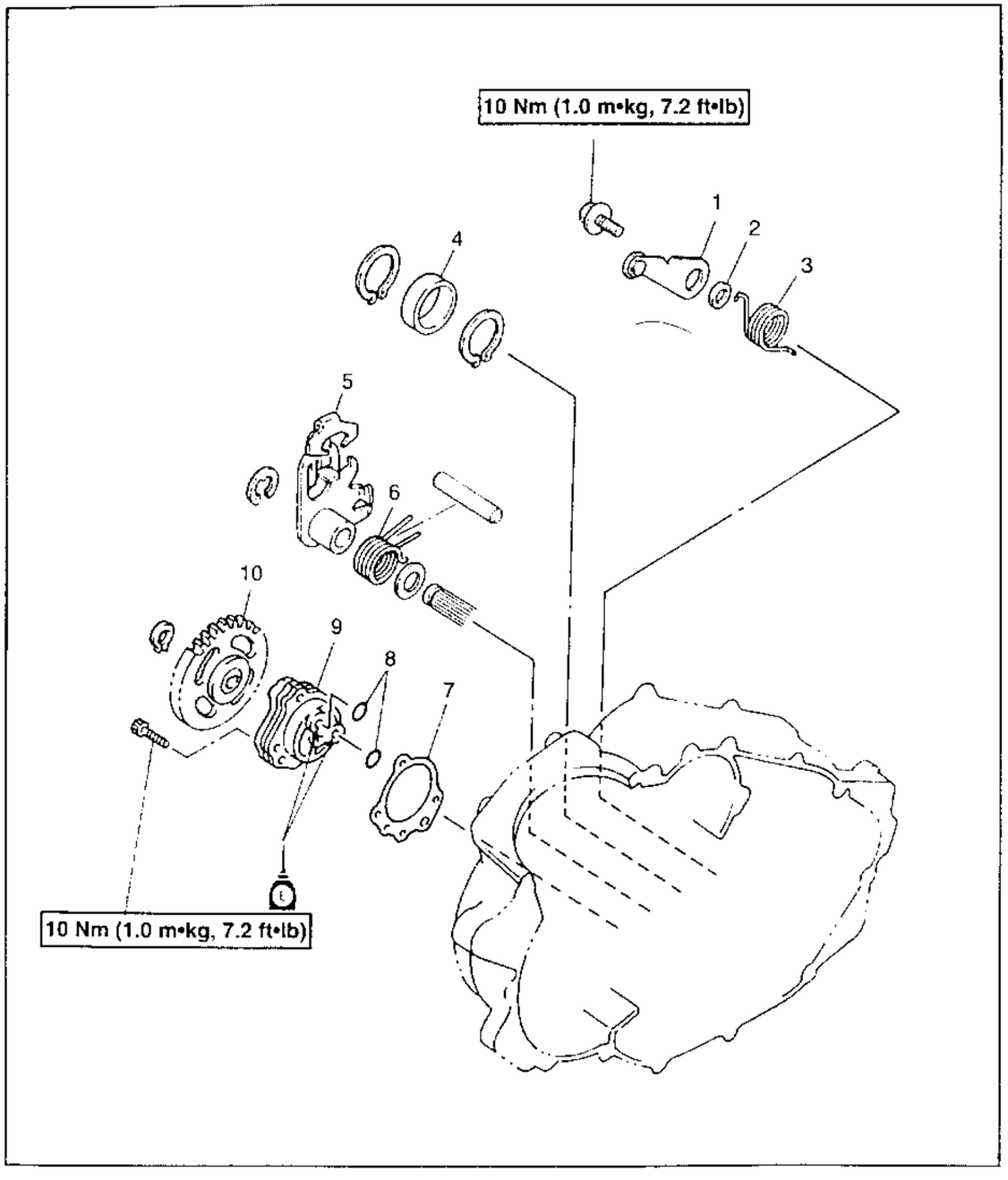
CRANKCASE

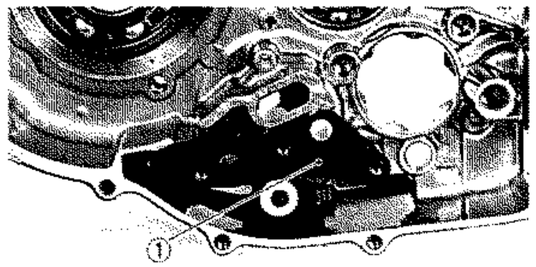
(1) Bearing cover plate
(2) Lock plate
(3) Crankcase ventilation hose
(4) Clamp
(5) Crankcase
(6) Collar
(7) Dowel pin
(8) Dowel pin
(9) O-ring



SHIFT LEVER AND OIL PUMP

(1) Stopper lever
(2) Collar
(3) Torsion spring
(4) Collar
(5) Shift lever
(6) Torsion spring
(7) Gasket
(8) O-ring
(9) Oil pump
(10) Oil pump gear

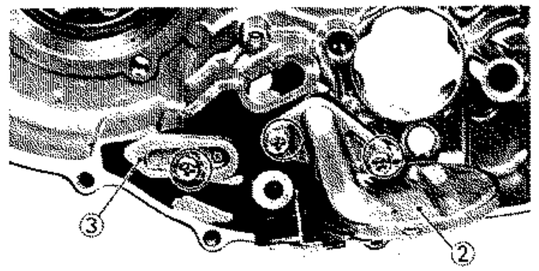




ENGINE OIL PUMP SUCTION

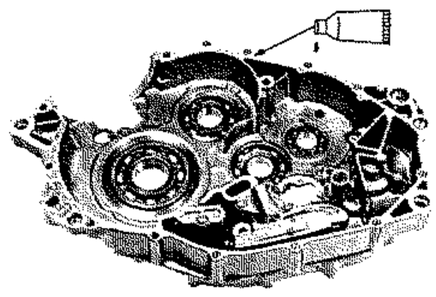
1. Install:
   - Gasket (1)
   - Oil pump suction (2)
   - Oil passage cover (3)

Screw (pump suction):
7 Nm (0.7 mkg)
Screw (oil passage cover):
7 Nm (0.7 mkg)



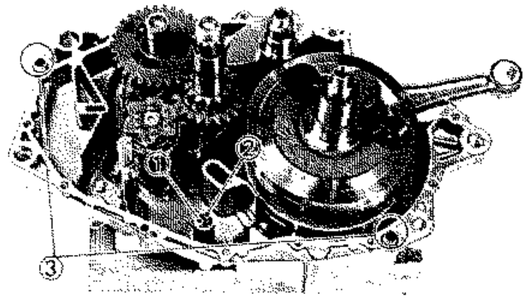
CRANKCASE

1. Apply:
   - Bonding agent
     (on the semicrank mating surfaces)



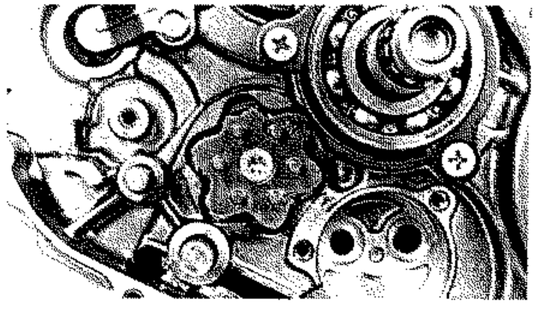
Bonding agent (Quick Gasket) ®:
P/N. ACC-11001-01
Yamaha bond N° 1215®:
P/N. 90890-85505

NOTE:
Do not allow any sealant to come in contact whit the oil gallery.

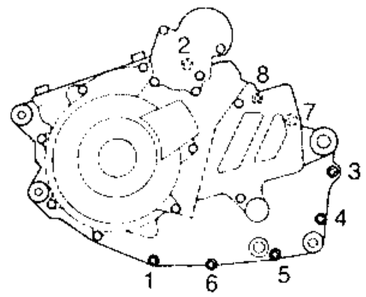


2. Install:
   - O-ring (1)
   - Dowel pin (2)
   - Dowel pins (3)
3. Assemble the left semicrank to the right semicrank. Beat gently with a soft hammer.

NOTE:
Turn the gear cam as shown in the figure so that it does not interfere with the crankcase during assembly.



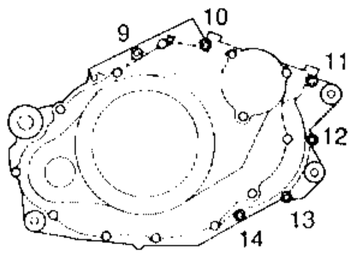
CAUTION:
Before installing and tightening the fastening screws, be sure that the transmission is working properly by hand, turning the gear cam in both directions.



4. Tighten:
   - Screws (crankcase) (1) ~ (14)

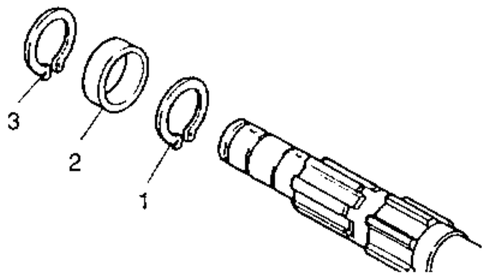
NOTE:
- Tighten the screws beginning with the one with the lowest number.
- Install the cable clamp on the bolt No. 4

	Screw (crankcase) (4): 10 Nm (1.0 mkg)



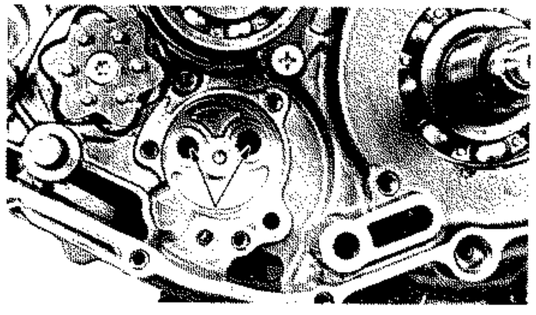
5. Apply:
   - 4-stroke engine oil (to the connecting rod pin, the bearing and the oil passage)

6. Check:
   - Gearbox and transmission functioning Jerky functioning → Repair.



SHIF LEVER AND OIL PUMP

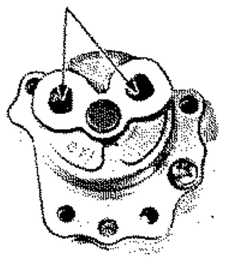
1. Install:
   - Circlip (1) (to drive axle)
   - Collar (2)
   - Circlip (3)



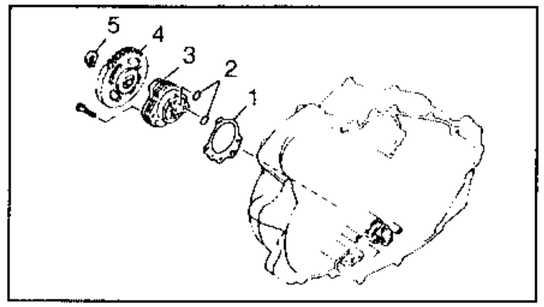
2. Apply
   - 4-stroke engine oil (to the oil pipes in crankcase)

CAUTION:

To avoid damage to the engine, lubricate the oil pump pipes in the crankcase liberally with 4-stroke engine oil.

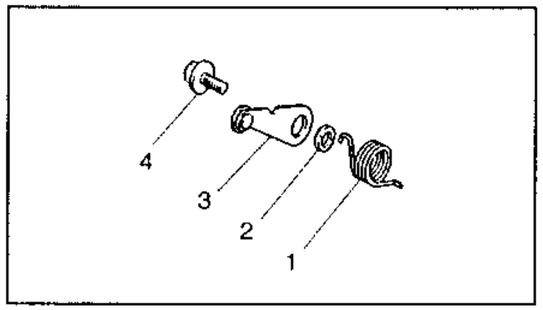


3. Apply:
   - 4-stroke engine oil (to the oil pump pipes)



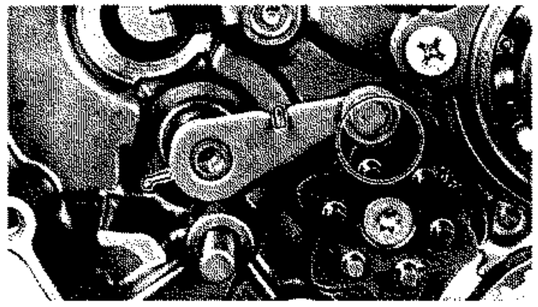
4. Install:
   - Gasket (1)
   - O-rings (2)
   - Oil pump (3)
   - Oil pump gear (4)
   - Circlip (5)

	Screw (oil pump): 10 Nm (1.0 mkg)

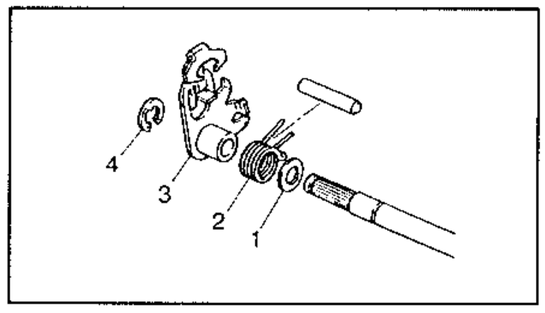


5. Install:
   - Spring (1)
   - Collar (2)
   - Stop lever (3)

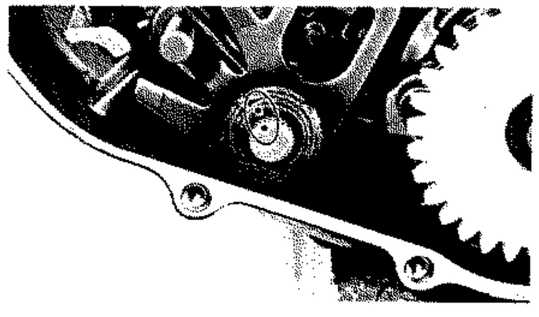
	Stop lever screw (4): 10 Nm (1.0 mkg)



NOTE:
Place the stop lever and the spring in the correct position.



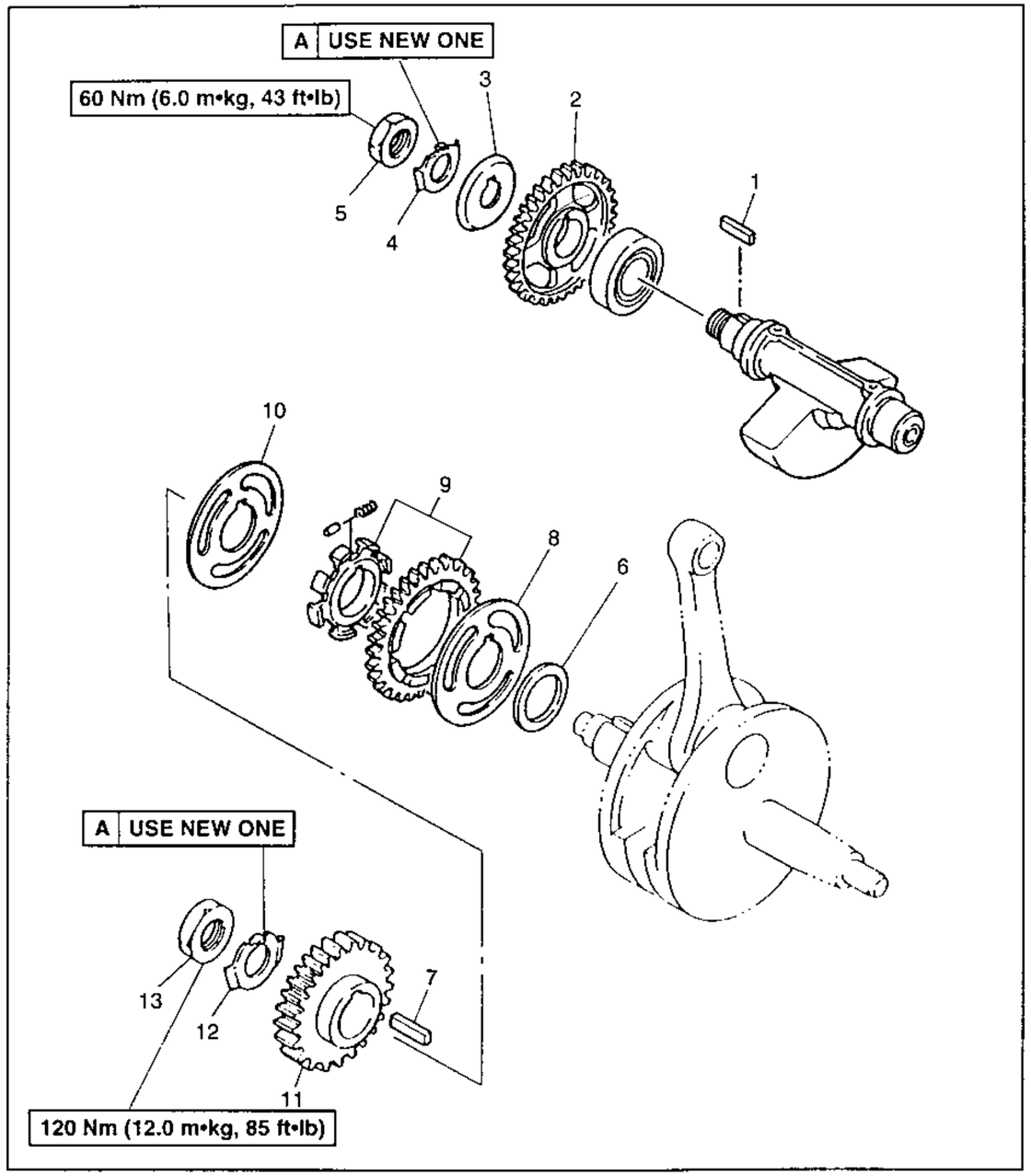
6. Install:
   - Flat washer (1)
   - Spring (2)
   - Shift lever (3)
   - Circlip (4)



NOTE:
When installing the shift lever, align the mark on the lever with that on the shitf shaft.

BALANCER SHAFT GEAR

(1) Key
(2) Balancer shaft gear
(3) Plate
(4) Lock washer
(5) Nut
(6) Washer
(7) Key
(8) Plate
(9) Balancer shaft transmission gear
(10) Plate
(11) Primary transmission gear
(12) Lock washer
(13) Nut



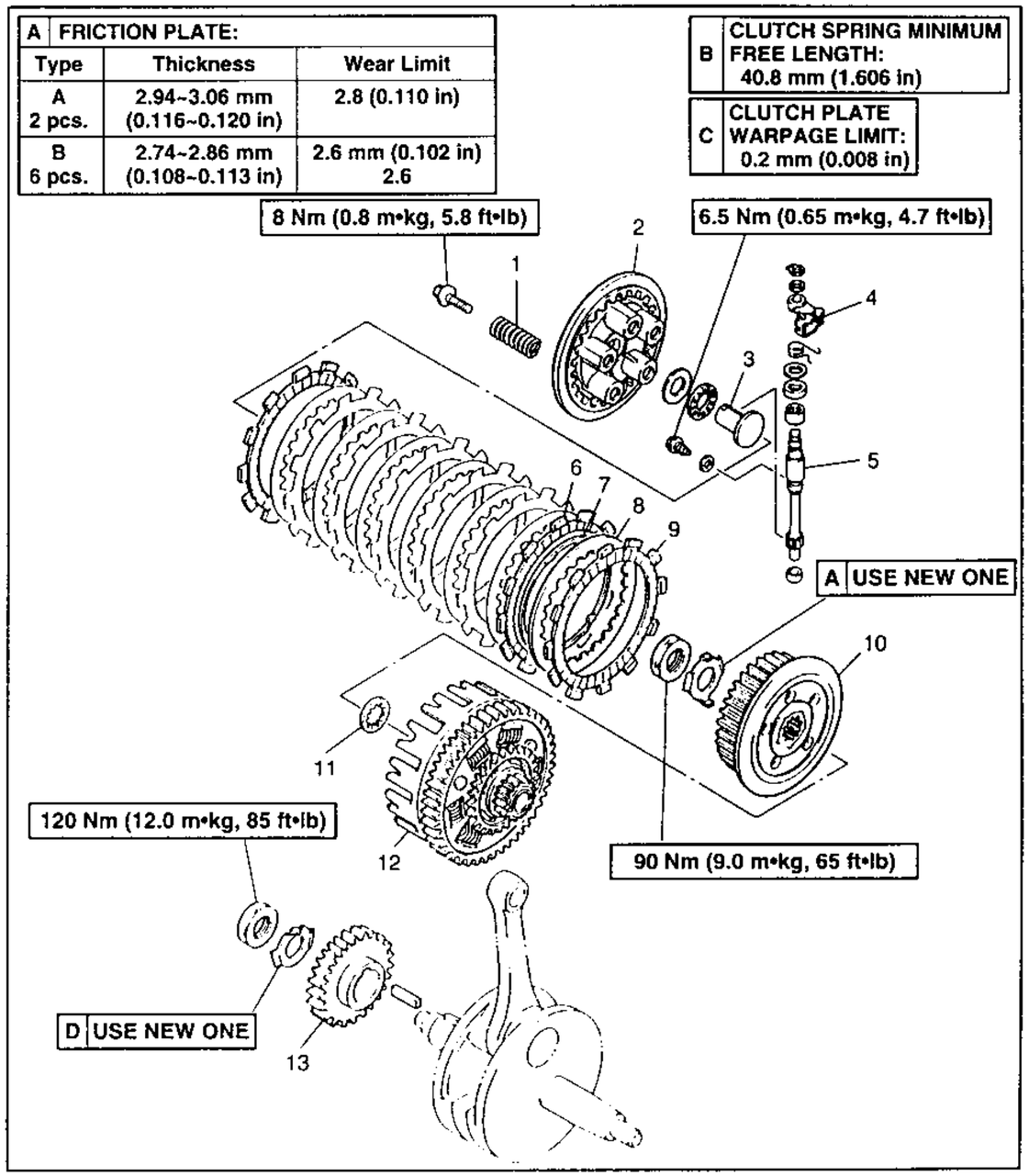
CLUTCH

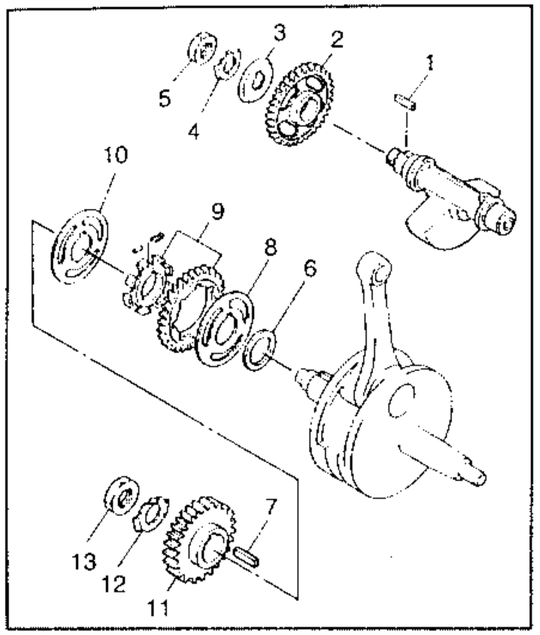
(1) Spring
(2) Pressure plate
(3) Push rod
(4) Push lever
(5) Push lever axle
(6) Friction plate (type A)
(7) Clutch boss spring
(8) Clutch plate
(9) Friction plate (type B)
(10) Clutch boss
(11) Thrust plate
(12) Gear assy
(13) Primary transmission gear

A	FRICTION PLATE:		
	Type	Thickness	Wear Limit
	A 2 pcs.	2.94~3.06 mm (0.116~0.120 in)	2.8 (0.110 in)
	B 6 pcs.	2.74~2.86 mm (0.108~0.113 in)	2.6 mm (0.102 in) 2.6

B CLUTCH SPRING MINIMUM FREE LENGTH: 40.8 mm (1.606 in)

C CLUTCH PLATE WARPAGE LIMIT: 0.2 mm (0.008 in)

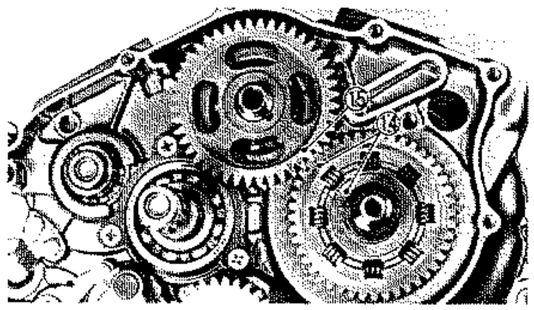


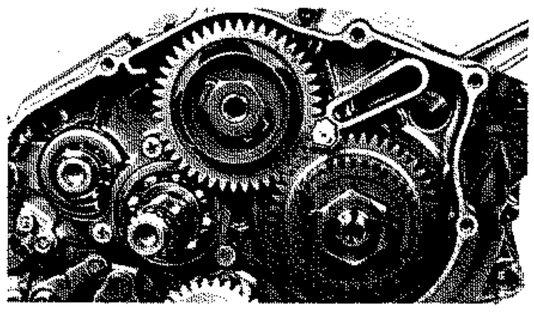


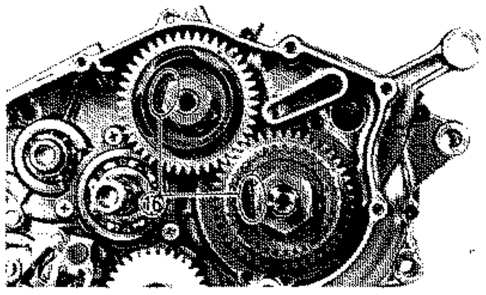
CLUTCH AND BALANCER GEAR

1. Install:
   - Key (1)
   - Balancer gear (2)
   - Plate (3)
   - Lock washer (4)
   - Nut (5) (balancer gear)
   - Plate washer (6)
   - Key (7)
   - Plate (8)
   - Balancer drive gear (9)
   - Plate (10)
   - Primary drive gear (11)
   - Lock washer (12)
   - Nut (13) (primary drive gear)

Nut (balancer gear):
60 Nm (6.0 mkg)
Nut (primary drive gear):
120 Nm (12.0 mkg)

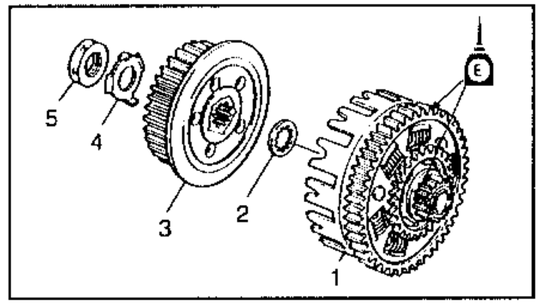


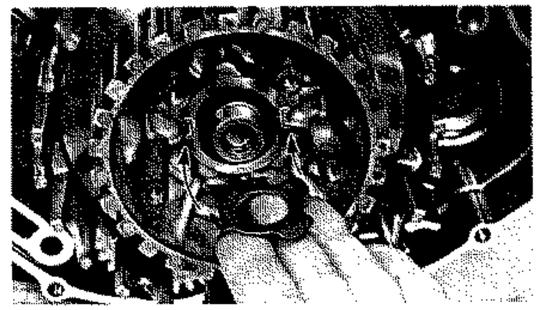


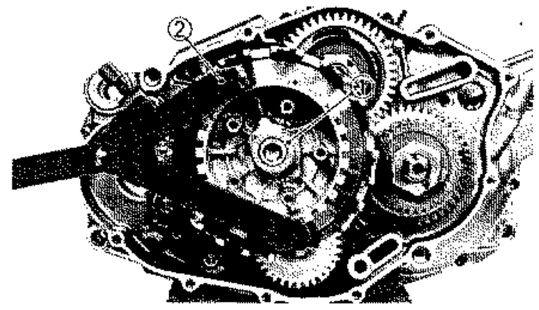


NOTE:
- When installing the drive gear, align the punched mark (14) on the drive gear with the punched mark (15) on the balancer gear.
- Place a folded rag or aluminum plate between the teeth of the balancer drive gear and balancer gear.
- Take care not to damage the gear teeth.

2. Bend the lock washer tab along the nut flat (16).







3. Apply:
   - Engine oil
     (onto bearing and gear teeth)

4. Install:
   - Clutch housing (1)
   - Thrust plate (2)
   - Clutch boss assembly (3)
   - Lock washer (4)
   - Nut (5) (clutch boss)

NOTE:
Fit the tabs of the lock washer to the groove of the clutch boss.

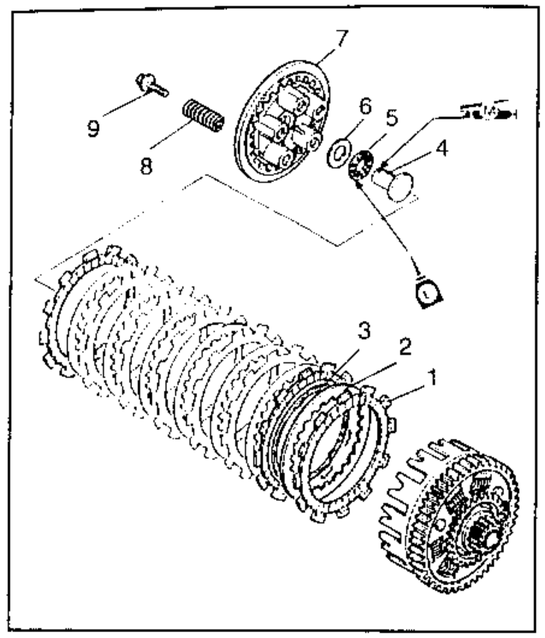
5. Tighten:
   - Nut (1) (clutch boss)

NOTE:
Tighten the nut (clutch boss) while holding the clutch boss with the universal clutch holder (2).

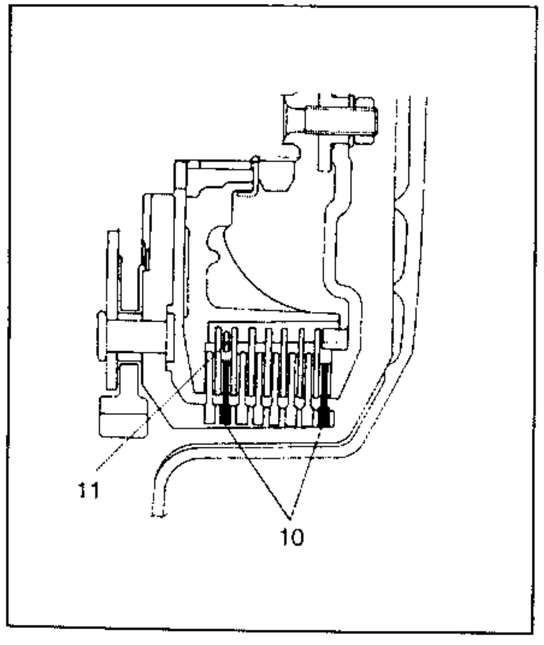
Universal clutch holder:
P/N YM-91042, 90890-04086

Nut (clutch boss):
90 Nm (9.0 mkg)

6. Bend:
   - Lock washer tab
     (along nut flat)
7. Apply:
   - Molybdenum disulfide grease
     (onto gear teeth of pull rod)
   - Engine oil
     (onto bearing pull rod)

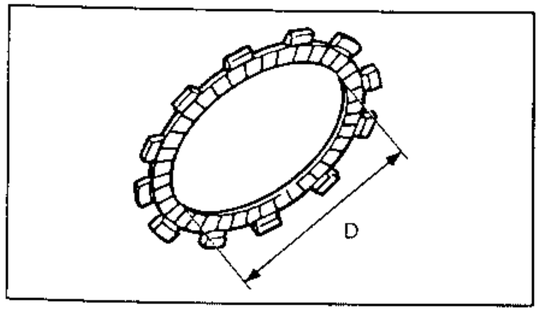


8. Install:
   - Friction plates (1)
   - Clutch plates (2)
   - Cushion spring (3)
   - Pull rod (4)
   - Bearing (5) (pull rod)
   - Washer (6)
   - Pressure plate (7)
   - Clutch springs (8)
   - Bolts (9)

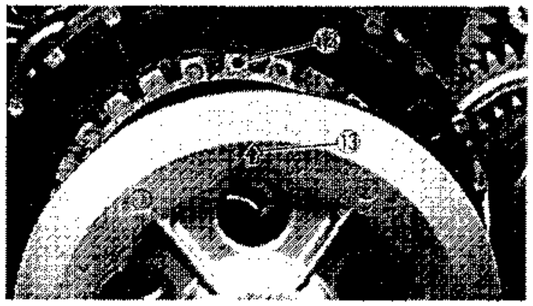


NOTE:
Install the clutch plates and friction plates alternately on the clutch boss, starting with a friction plate and ending with a friction plate.

CAUTION:
- **The friction plates (type A) (10) with the larger of the inside diameter must be installed in the second and last places.**
- **The cushion spring (11) must be placed on the inside of the second friction plate.**

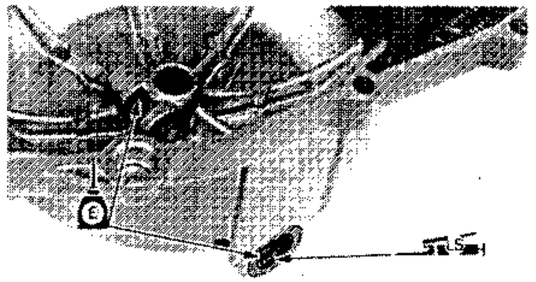


	Friction plate	
	Type "A"	Type "B"
Quantity	2 pcs	6 pcs
Inside diameter "D"	116 mm	113 mm

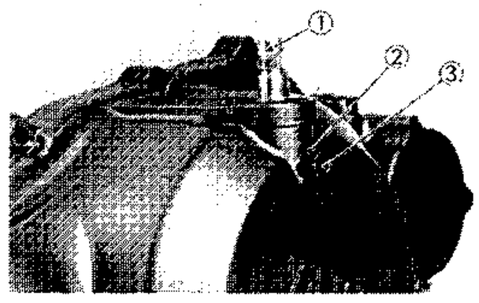


NOTE:
Align the punched mark (12) on the clutch boss with the arrow mark on the clutch pressure plate (13).

	Screw (pressure plate): 8 Nm (0.8 mkg)

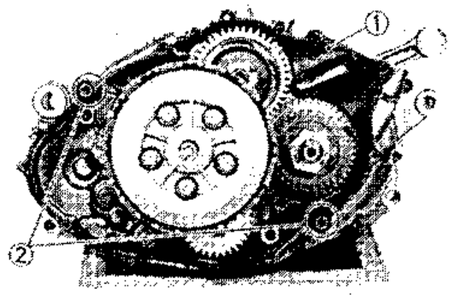


9. Apply:
   - Lithium soap base grease (onto seal lips in crankcase cover)
   - Engine oil (onto bearings in crankcase cover)

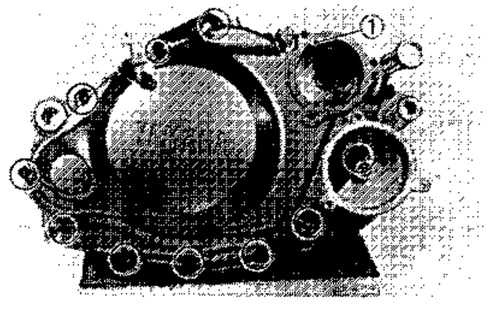


10. Install:
   - Pull lever axle (1)
   - Washer (2)
   - Bolt (3)

	Bolt (pull lever axle): 6.5 Nm (0.65 mkg)



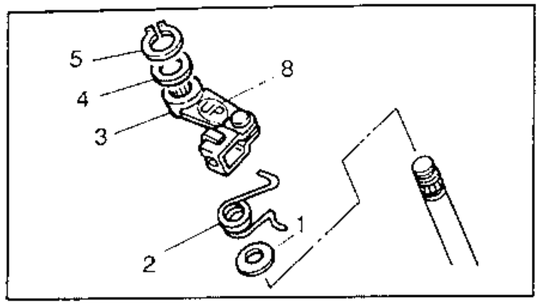
11. Install:
   - Gasket (1) (crankcase cover)
   - Dowel pins (2)



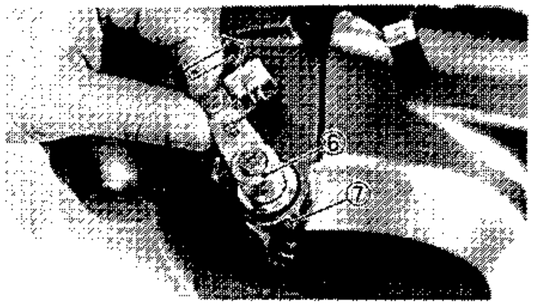
12. Install:
   - Crankcase cover (1) (right)

	Bolt (crankcase cover): 10 Nm (1.0 mkg)

NOTE:
Tighten the bolts (crankcase cover) in a crisscross pattern.

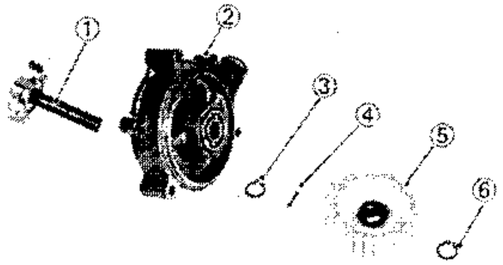


13. Install:
    - Washer (1)
    - Return spring (2)
    - Pull lever (3)
    - Washer (4)
    - Circlip (5)

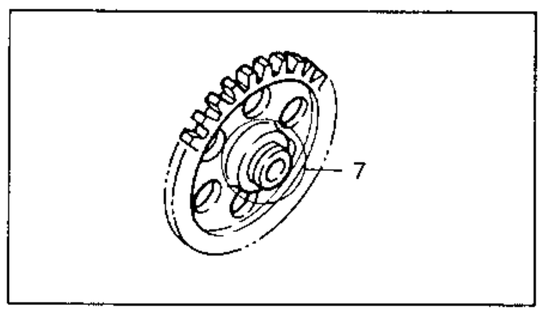


NOTE:
- Make sure that the mark (6) on the pull lever is aligned whit the embossed mark (7) on the crankcase while pushing the pull lever. If not, change the pull lever position.
- Install the pull lever whit the "UP" mark (8) facing upward.

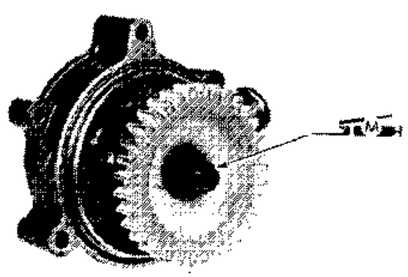
OIL FILTER AND WATER PUMP



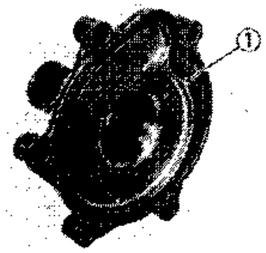
1. Install:
    - Impeller shaft (1)
    - Water pump housing (2)
    - Circlip (3)
    - Pin (4)
    - Water pump gear (5)
    - Circlip (6)



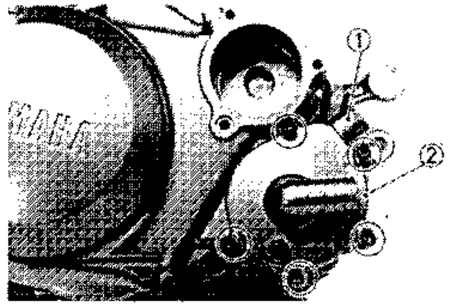
NOTE:
Install the water pump with embossed side (7) facing to inside.



2. Apply:
    - Molybdenum disulfide grease (onto impeller shaft end)

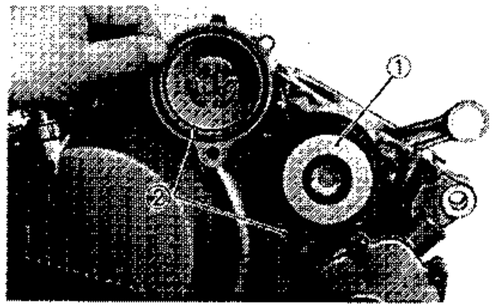


3. Install:
    - O-ring (1)

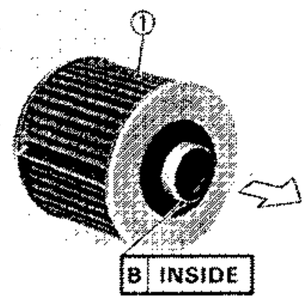


4. Install:
    - Water pump housing (1)
    - Water pump cover (2)

	Bolt (water pump): 10 Nm (1.0 mkg)

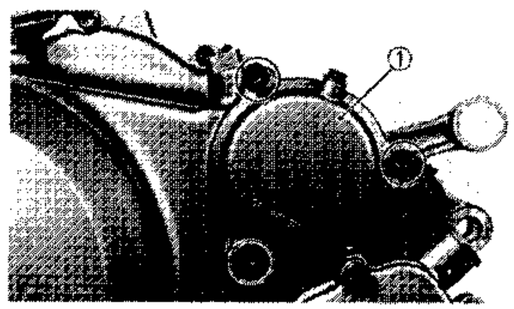


5. Install:
    - Oil filter (1)
    - O-rings (2)



CAUTION:
Install the oil filter as shown.

B INSIDE

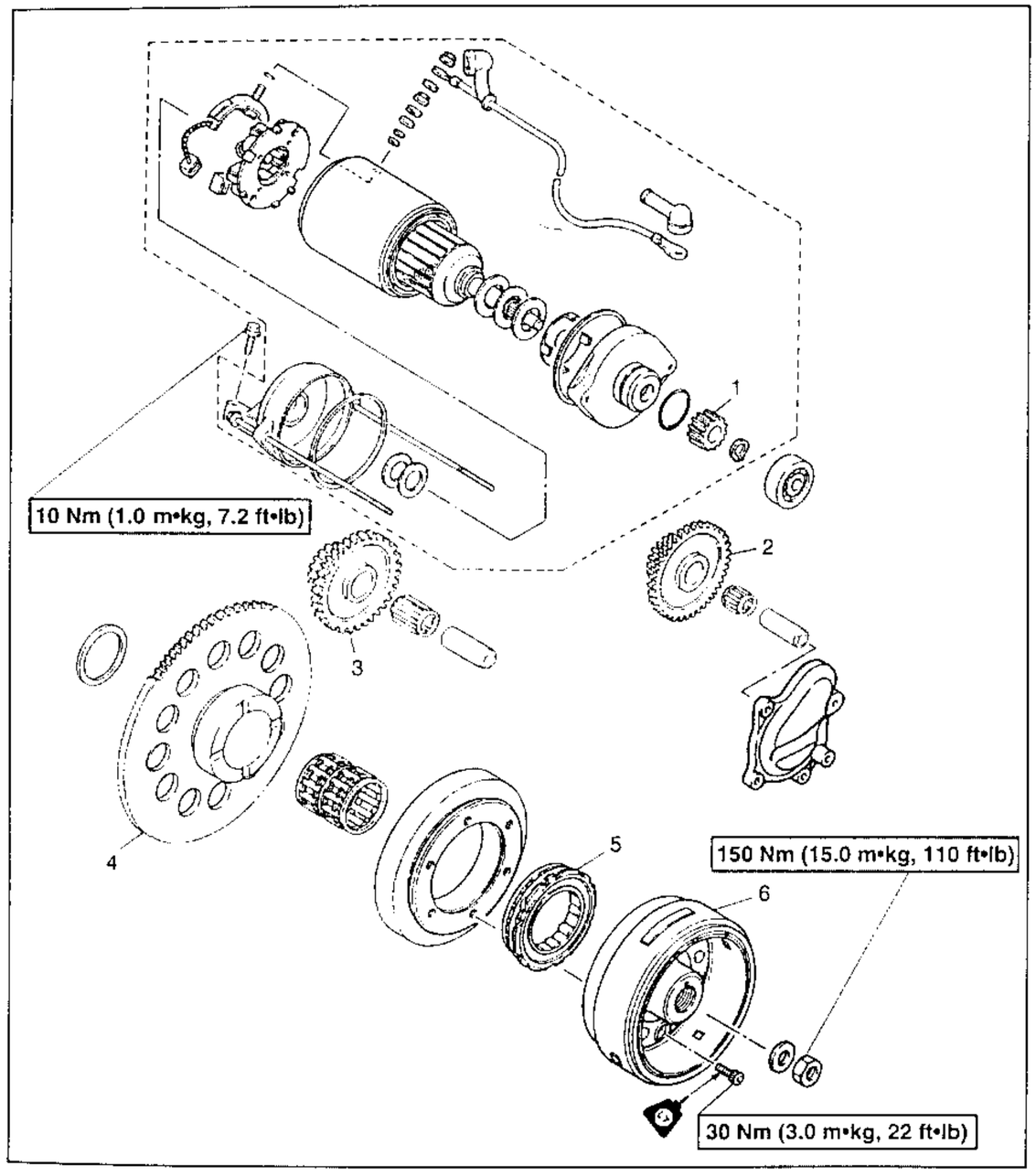


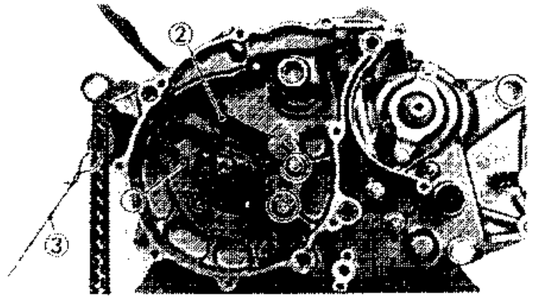
6. Install:
    - Oil filter cover (1)

	Bolt (oil filter cover): 10 Nm (1.0 mkg)

STARTER GEARS AND ROTOR

(1) Starter gear
(2) Starter neutral gear 1
(3) Starter neutral gear 2
(4) Starter gear
(5) Starter clutch
(6) Rotor (A.C.generator)



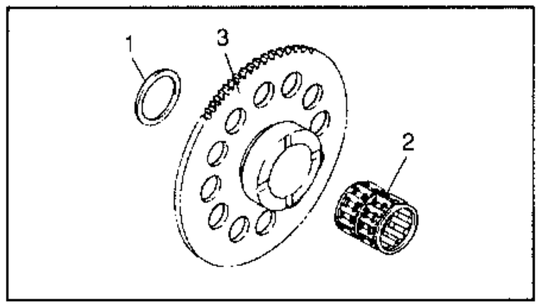


1. Install:
   - Timing chain (1)
   - Chain guide (2)

	Bolt (chain guide): 10 Nm (1.0 mkg)

NOTE:
Fasten a safety wire (3) to the timing chain to prevent it from falling into crankcase.

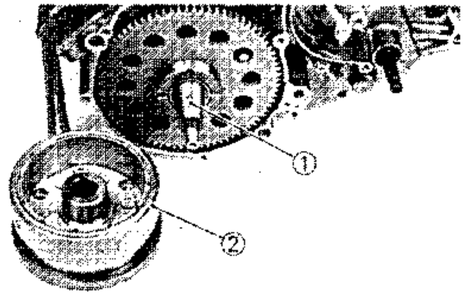
2. Apply:
   - Lithium soap base grease (onto bearing on starter drives)



3. Install:
   - Washer (1)
   - Needle bearing (2)
   - Wheel gear (3)

4. Install:
   - Woodruff key (1)
   - Rotor (2)

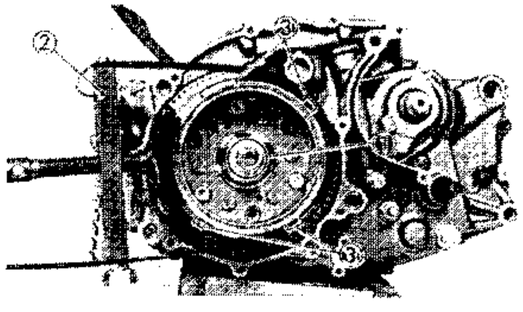
NOTE:
When installing the magneto rotor, make sure thet the woodruff key is properly seated in the keyway of the crankshaft.



5. Install:
   - Nut (1) (rotor)

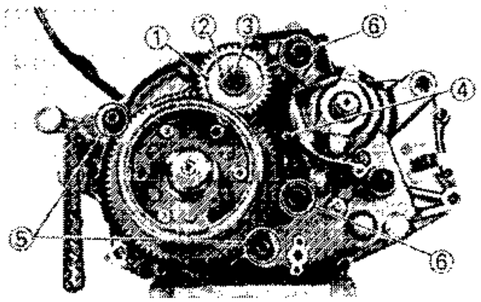
	Nut (rotor): 150 Nm (15.0 mkg)

NOTE:
Tighten the nut (rotor) while holding the rotor with the rotor holder (2).

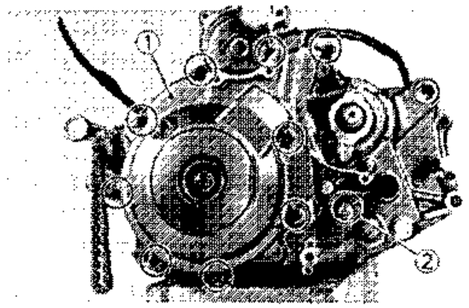


	Rotor holder: P/N YS-01880, 90890-01701

CAUTION:
Do not allow the rotor holder to touch the projections (3) on the rotor.



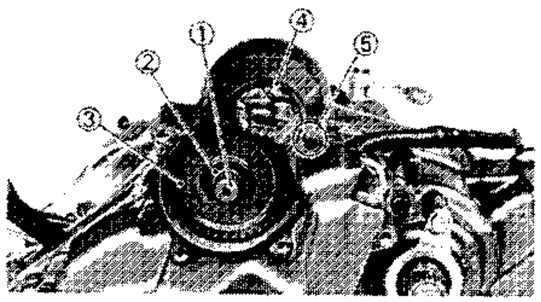
6. Install:
   - Starter idle gear 2 (1)
   - Needle bearing (2)
   - Shaft (3)
   - Gasket (4) (crankcase cover)
   - Dowel pins (5)
   - O-rings (6)



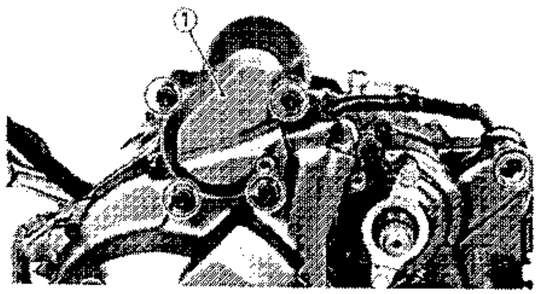
7. Install:
   - Crankcase cover (1) (left)

	Bolt (crankcase cover): 10 Nm (1.0 mkg)

NOTE:
Tighten the bolts (crankcase cover) in a crisscross pattern.



8. Connect:
   - Neutral switch (2)
9. Install:
   - Shaft (1) (starter idle gear)
   - Needle bearing (2)
   - Starter idle gear (3)
   - Gasket (4)
   - Dowel pin (5)



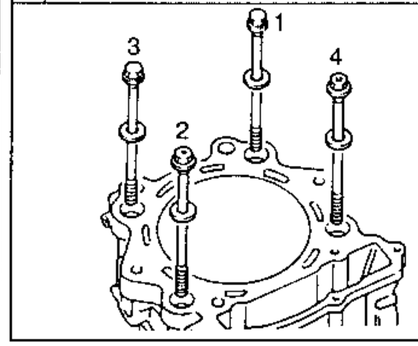
10. Install:
    - Cover (1)

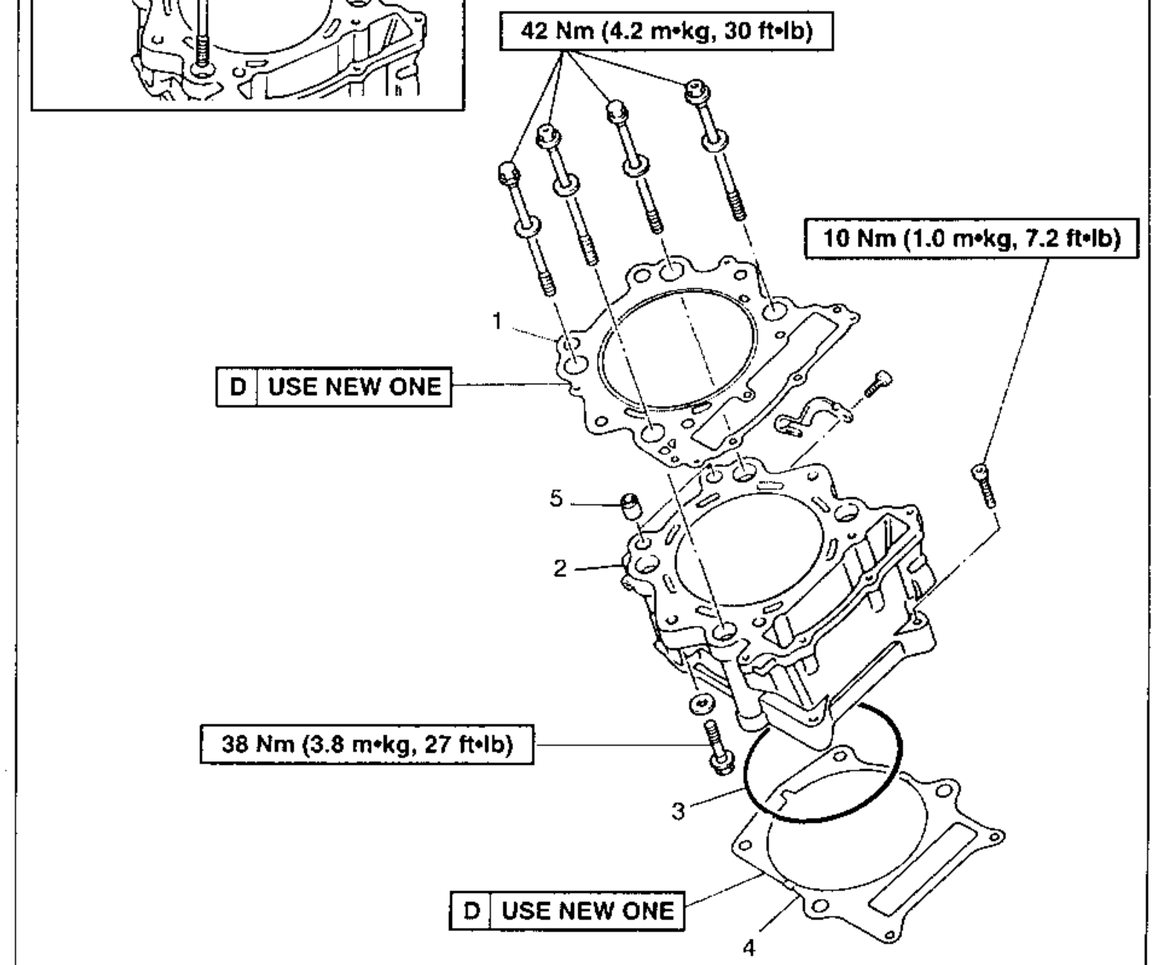
	Bolt (cover): 10 Nm (1.0 mkg)

CYLINDER

(1) Cylinder head gasket
(2) Cylinder
(3) O-ring
(4) Cylinder gasket
(5) Dowel pin

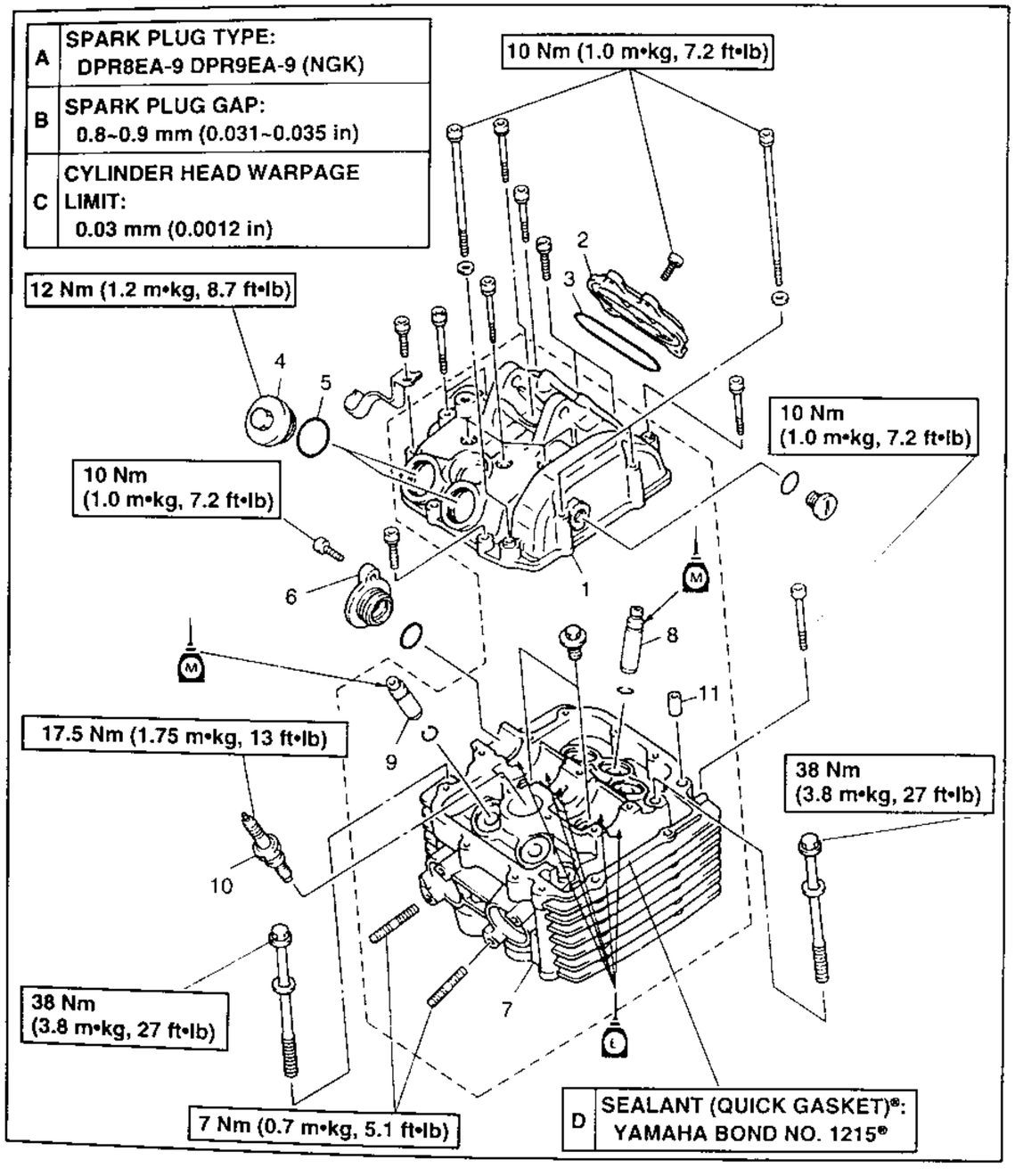
A	**TIGHTENING SEQUENCE:**
B	**BORE SIZE: 100.005~100.045 mm (3.9372~3.9388 in) <LIMIT>: <100.1 mm (3.941 in)>**
C	**PISTON-TO-CYLINDER CLEARANCE: 0.005~0.070 mm (0.0020~0.0028 in) <LIMIT>: <0.15 mm (0.0059 in)>**





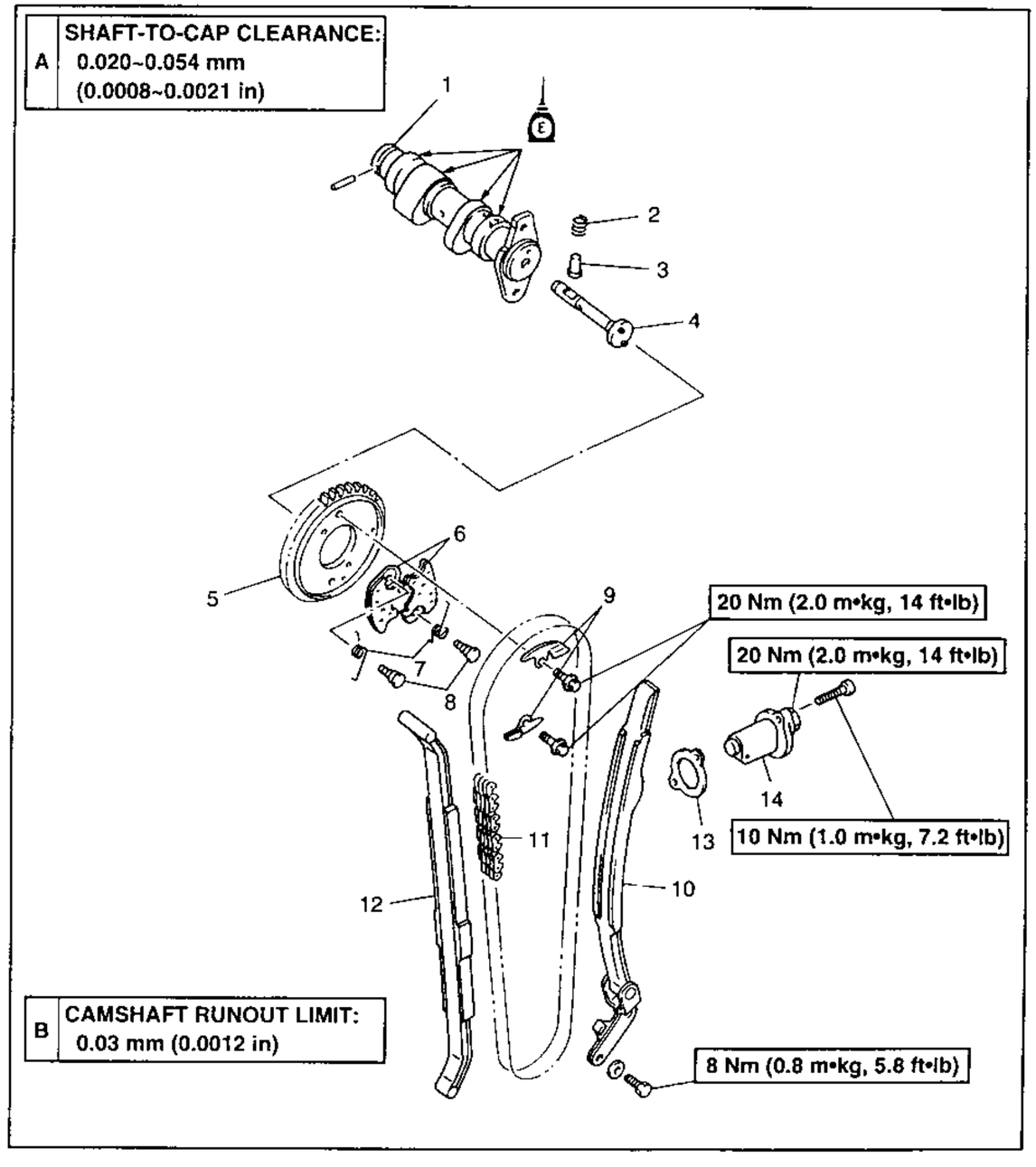
CYLINDER HEAD

(1) Cylinder head cover
(2) Tappet cover (intake)
(3) O-ring
(4) Tappet cover (exhaust)
(5) O-ring
(6) Cap
(7) Cylinder head
(8) Valve guide (intake valve)
(9) Valve guide (exhaust valve)
(10) Spark plug
(11) Dowel pin


A SPARK PLUG TYPE: DPR8EA-9 DPR9EA-9 (NGK)
B SPARK PLUG GAP: 0.8~0.9 mm (0.031~0.035 in)
C CYLINDER HEAD WARPAGE LIMIT: 0.03 mm (0.0012 in)
10 Nm (1.0 m•kg, 7.2 ft•lb)
12 Nm (1.2 m•kg, 8.7 ft•lb)
10 Nm (1.0 m•kg, 7.2 ft•lb)
10 Nm (1.0 m•kg, 7.2 ft•lb)
17.5 Nm (1.75 m•kg, 13 ft•lb)
38 Nm (3.8 m•kg, 27 ft•lb)
38 Nm (3.8 m•kg, 27 ft•lb)
7 Nm (0.7 m•kg, 5.1 ft•lb)
D SEALANT (QUICK GASKET)®: YAMAHA BOND NO. 1215®
1
2
3
4
5
6
7
8
9
10
11

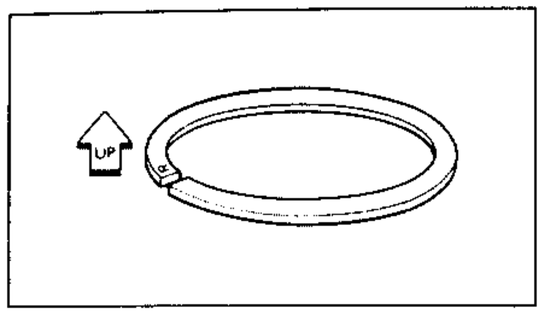
CAMSHAFT AND CAMSHAFT CHAIN

(1) Camshaft
(2) Spring
(3) Decompression lever pin
(4) Decompression lever
(5) Cam chain sprocket
(6) Decompression cam
(7) Spring
(8) Tensioner shaft
(9) Guide stopper plates
(10) Guide stopper (intake)
(11) Timing chain
(12) Guide stopper (exhaust)
(13) Gasket
(14) Cam chain tensioner



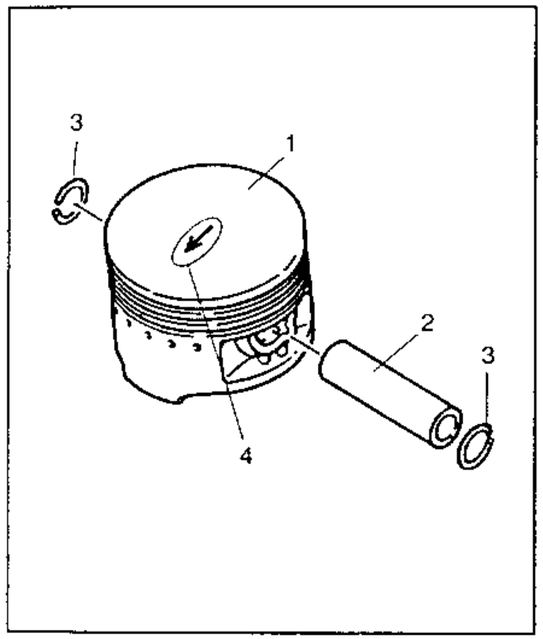
CYLINDER HEAD, CYLINDER AND PISTON

1. Apply:
   - Engine oil
   (onto piston rings and piston pin)



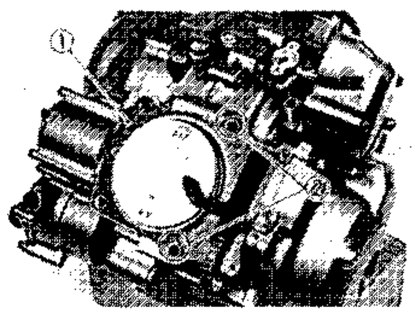
2. Install:
   - Piston rings

NOTE:
Be sure to install ring so that manufacture marks or numbers are located on the top side of the rings.

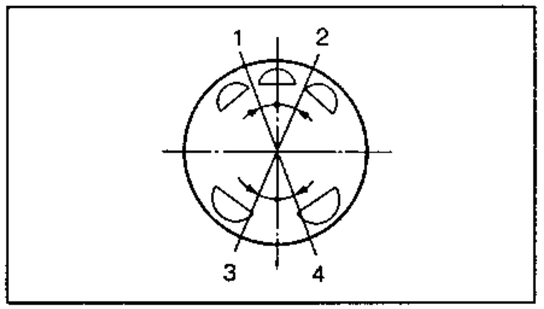


3. Install:
   - Piston (1)
   - Piston pin (2)
   - Circlips (3)

NOTE:
- The allow (4) on the piston must point to the front of the engine.
- Before installing the circlip, cover the crankcase with a clean towel or rag so you will not accidentally drop the pin clip and material into the crankcase.

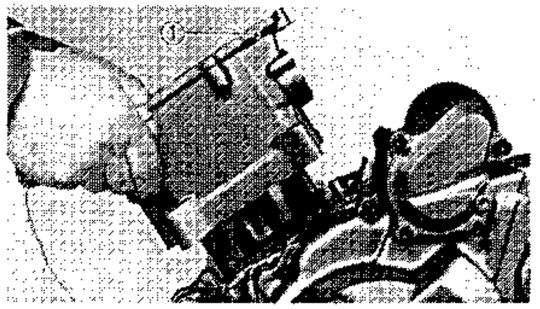


4. Install:
   - Gasket (1) (cylinder)
   - Dowel pins (2)

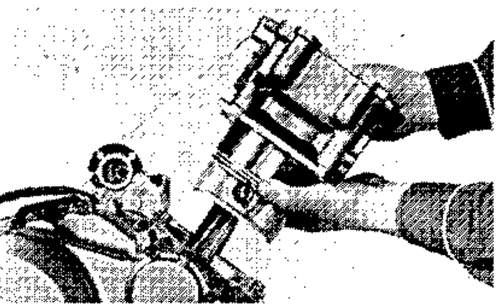


5. Position:
   - Top ring
   - 2nd ring
   Offset the piston ring end gaps as shown.

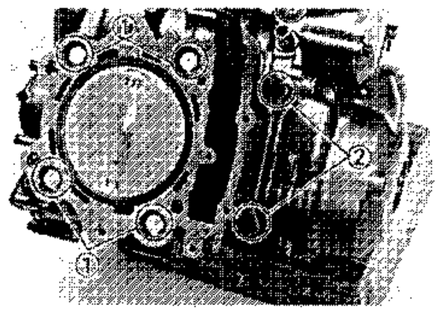
(1) Top ring end
(2) Oil ring end (lower)
(3) Oil ring end (upper)
(4) 2nd ring end



6. Install:
   - Cylinder (1)



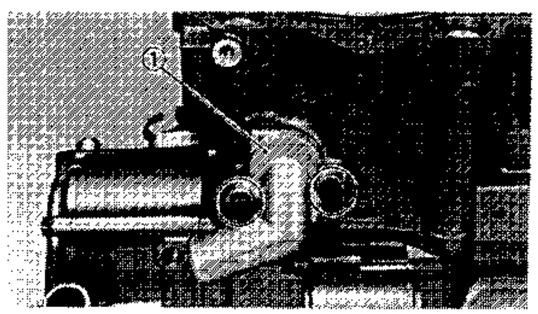
NOTE:
Install the cylinder while compressing the piston rings by the hand.



7. Install:
   - Bolts (1)
   - Bolts (2)

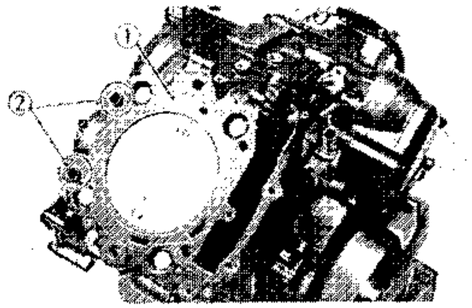
	Bolts (1): **42 Nm (4.2 mkg)** **Bolts (2):** **10 Nm (1.0 mkg)**

NOTE:
Tighten the bolts (1) in a crisscross pattern.

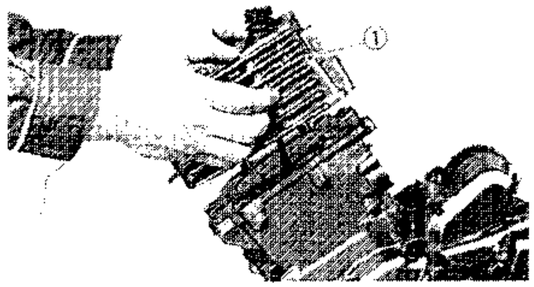


8. Install:
   - Pipe (1)

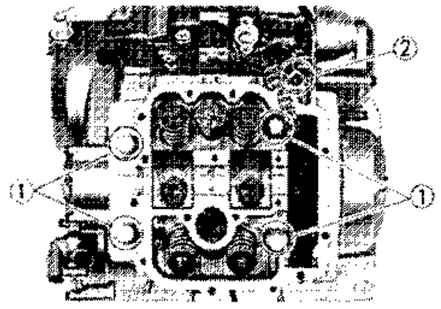
	Bolt (pipe): **10 Nm (1.0 mkg)**



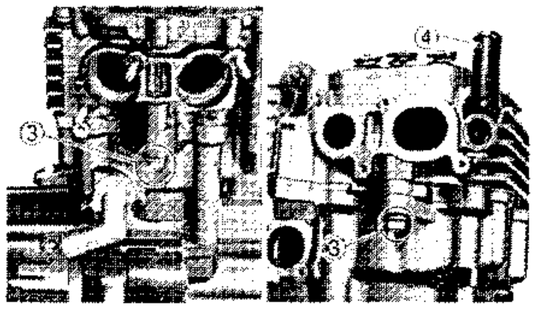
9. Install:
   - Gasket (1) (cylinder head)
   - Dowel pins (2)



10. Install:
    - Cylinder head (1)

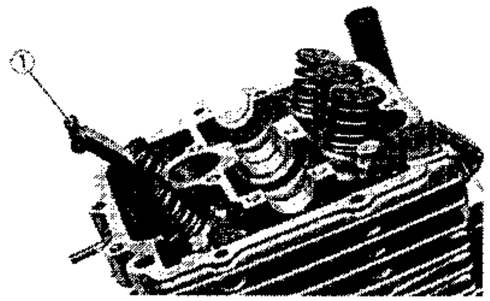


11. Install:
    - Bolts (1)
    - Bolt (2)
    - Bolts (3)
    - O-ring (pipe (4)
    - Pipe (4)

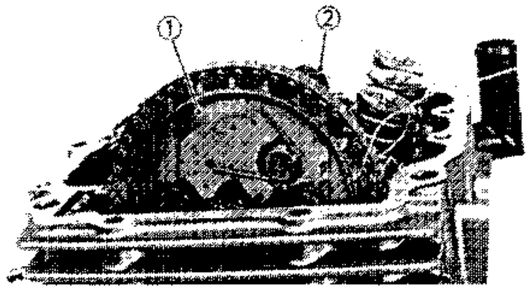


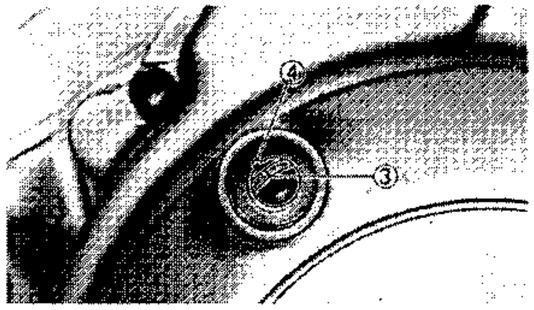
	Bolts (1), (3): **38 Nm (3.8 mkg)** **Bolt (2):** **10 Nm (1.0 mkg)**

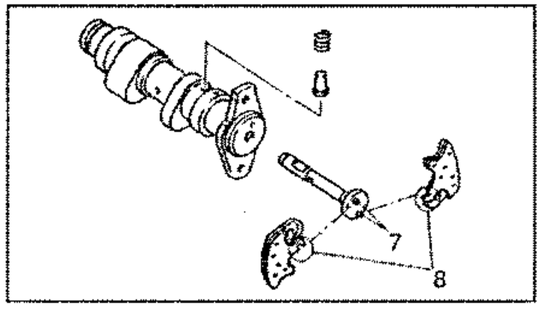
NOTE:
- Apply the engine oil onto the O-ring.
- Tighten the bolts (1) in a crisscross pattern.



12. Install:
    - Chain guide (1) (exhaust)



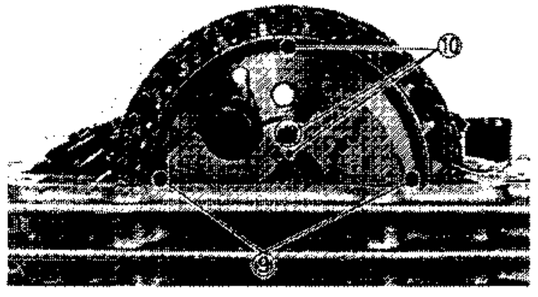




13. Install:
    - Cam sprocket (1)
    - Camshaft (2)

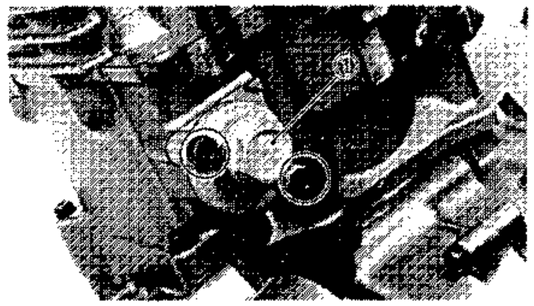
Installing steps:
- Turn the crankshaft counterclockwise until the TDC mark (3) is aligned whit the stationary pointer (4).
- Align the match mark on the camshaft with the punched mark on the decompression lever.
- Fit the timing chain onto cam sprocket and install the cam sprocket on the camshaft.

NOTE:
- When installing the cam sprocket, keep the timing chain as tense as possible on the exhaust side.
- Align the pins (7) on the decompression lever with the slots (8) in the decompression cam.
- Set the respective match marks (9) to be parallel with the case surface on the corresponding sides, and align the respective match marks (10) to be vertical.

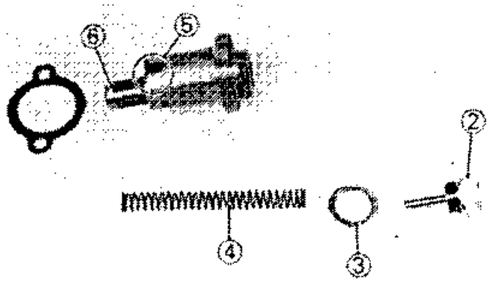


CAUTION:
Do not turn crankshaft during the camshaft installation. Damage or improper valve timing will result.

- While holding the camshaft, temporary tighten the bolts.



14. Install:
    - Chain tensioner (1)

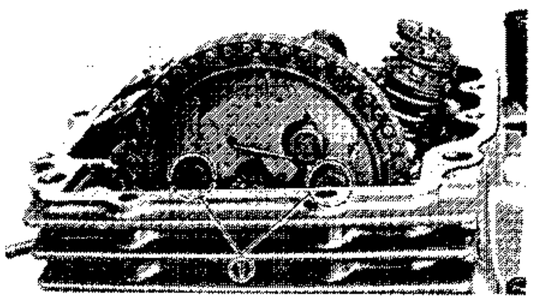


Installing steps:
- Remove the cap bolt (2), washer (3) and spring (4).
- Release the ratchet (5) and push the tension rod (6).
- Install the chain tensioner with the ratchet end facing downward.
- Tighten the bolts.

	Bolt (chain tensioner): **10 Nm (1.0 mkg)**

- Install the spring (4), washer (3) and cap bolt (2).

	Cap bolt (timing chain tensioner): **20 Nm (2.0 mkg)**



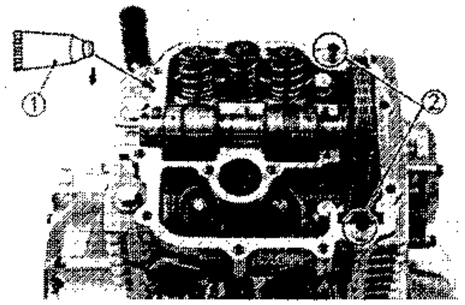
15. Tighten:
    - Bolts (1) (cam sprocket)

	Bolts (cam sprocket): **20 Nm (2.0 mkg)**

16. Check:
    - Valve timing
      Out of alignment → Adjust.
      Refer to above steps 13 ~ 15.

17. Check:
    - Valve clearance
      Out of specification → Adjust.
      Refer to "VALVE CLEARANCE ADJUSTMENT" section in CHAPTER 3.

	Intake valve (cold): **0.10 ~ 0.15 mm** **Exhaust valve (cold):** **0.15 ~ 0.20 mm**



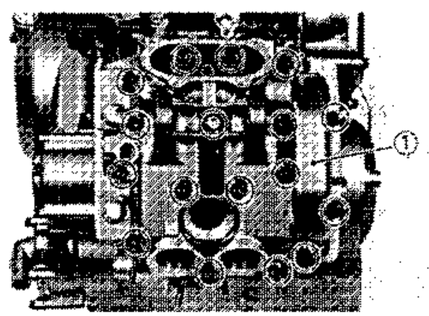
18. Apply:
    - Sealant (1)
      (onto the cylinder head mating surfaces)

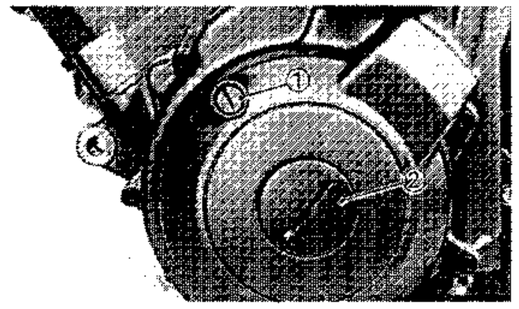
	Sealant (quick gasket)®: **P/N. ACC-11001-01** **Yamaha Bond N° 1215®:** **P/N. 90890-85505**

19. Install:
    - Dowel pins (2)
20. Install:
    - Cylinder head cover (1)

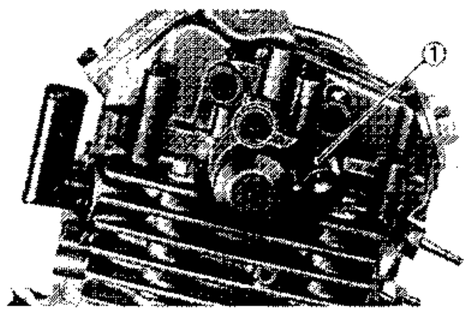
NOTE:
Tighten the bolts in stage, using a crisscross pattern.

	Bolt (cylinder head cover): **10 Nm (1.0 mkg)**



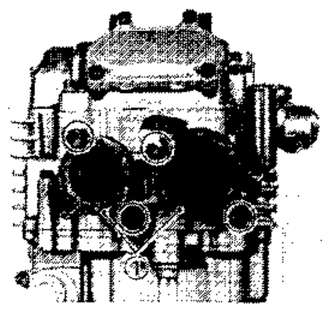


21. Install:
    - Timing plug (1)
    - Plug (2)



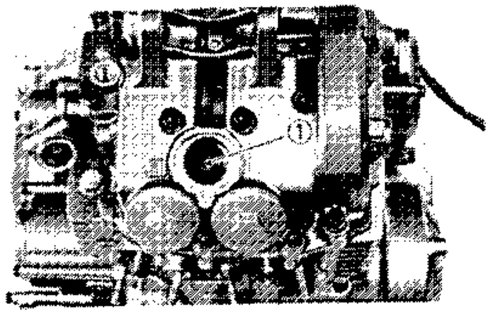
22. Install:
    - Cap (1)

	Bolt (cylinder head cap): **10 Nm (1.0 mkg)**



23. Install:
    - Intake manifolds (1)

	Bolt (intake manifold): **10 Nm (1.0 mkg)**

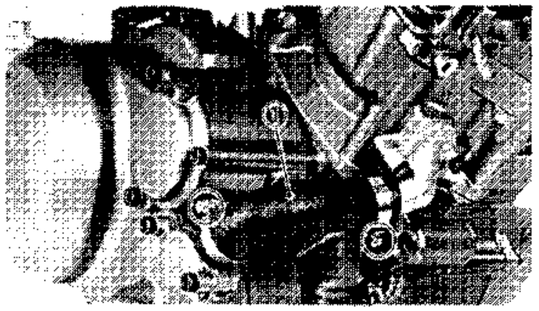


24. Install:
    - Spark plug (1)

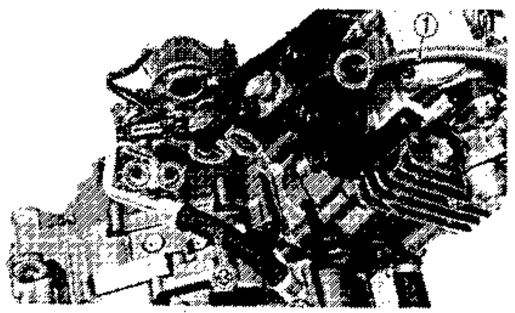
	Spark plug: **18 Nm (1.8 mkg)**

PIPES AND HOSES

1. Apply:
    - Lithium soap base grease (onto O-rings on oil pipes)

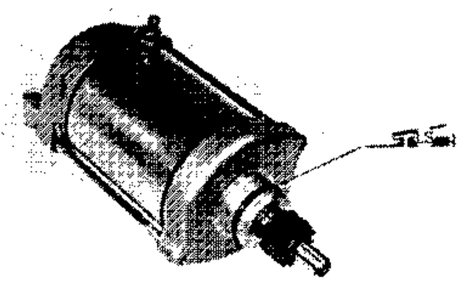


2. Install:
    - Coolant hose (1)

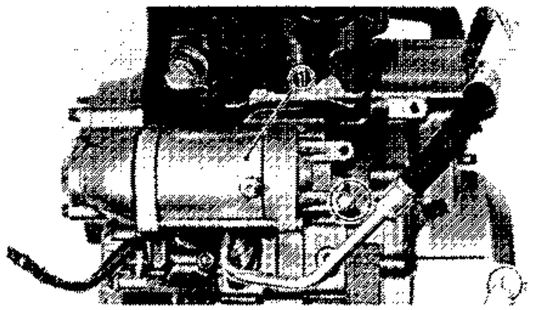


3. Install:
    - Breather hose (1) (crankcase)
    - Oil hose (3)

	Bolts (oil hose): **10 Nm (1.0 mkg)**

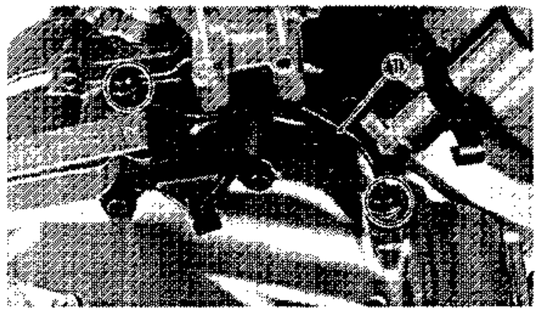


4. Apply:
    - Lithium soap base grease (onto O-ring on starter motor)



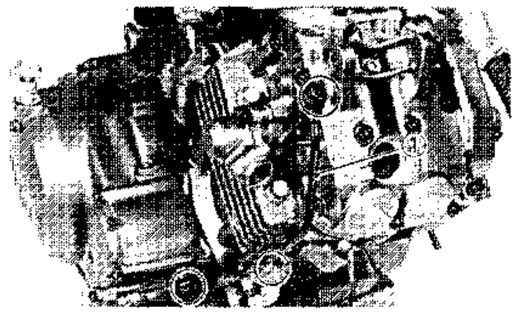
5. Install:
    - Starter motor (1)

	Bolt (starter motor): **10 Nm (1.0 mkg)**



6. Install:
    - Oil pipe (1)

	Union bolt (oil pipe): **20 Nm (2.0 mkg)** **Bolt:** **10 Nm (1.0 mkg)**



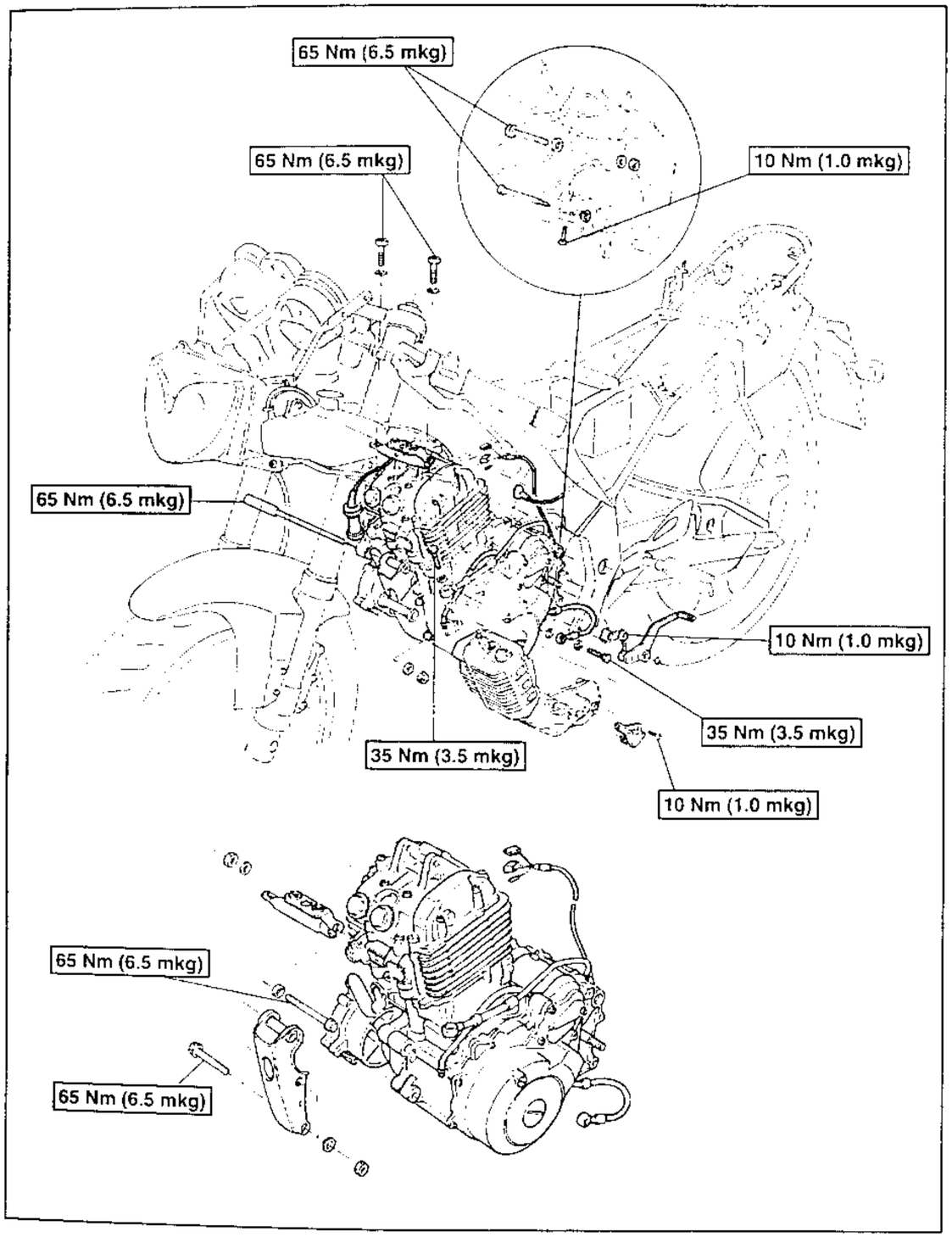
7. Install:
    - Oil pipe (1)

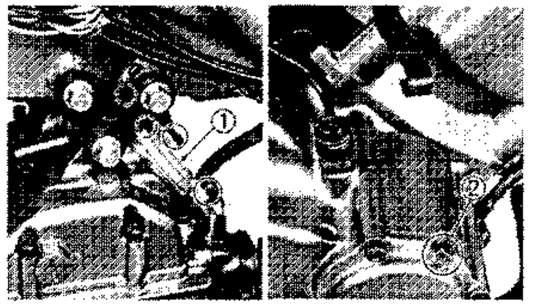
	Union bolt (oil pipe): **20 Nm (2.0 mkg)**

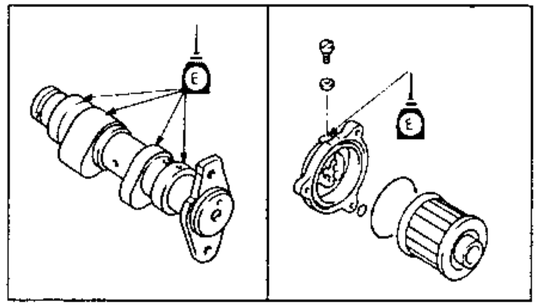
ENGINE REASSEMBLY

When reassembling the engine, reverse the removal procedure. Note the following points.

NOTE:
Install the bolts and nuts first, and then tighten the bolts and nuts to specifications.







1. Remove:
   - Tappet cover (1) (intake)
   - Air bleed screw (2) (oil filter cover)
2. Apply:
   - 4-stroke engine oil
     (to the camshaft upper side and into the oil filter chamber)

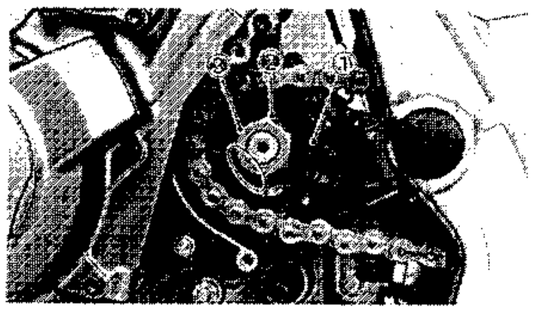
⚠ WARNING

Apply a liberal amount of 4-stroke engine oil to the oil passage in the crankcase, or the engine may be damaged.

Oil quantity:
Camshaft:
0.1 L
Oil filter chamber:
0.06 L

3. Install:
   - Tappet cover (intake)
   - Air bleed screw (oil filter cover)

Bolt (tapped cover):
10 Nm (1.0 mkg)
Air bleed screw:
5 Nm (0.5 mkg)



4. Install:
   - Drive sprocket (1)
   - Lock washer (2)
   - Nut (3)

Nut (drive sprocket):
110 Nm (11.0 mkg)

5. Bend:
   - Lock washer tab
     (along nut flat)
6. Adjust:
   - Drive chain slack
     Refer to the "DRIVE CHAIN SLACK ADJUSTMENT" section in CHAPTER 3°.

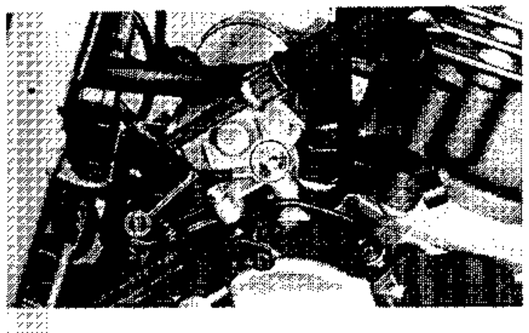
Drive chain slack:
25 ~ 40 mm

7. Install:
   - Sprocket cover

	Screw (sprocket cover): **10 Nm (1.0 mkg)**

8. Install:
   - Shift pedal

	Bolt (shift pedal): **10 Nm (1.0 mkg)**



9. Connect:
   - Ground lead (1)
     Refer to the "CABLE ROUTING" section in CHAPTER 2°.

	Nut (ground lead): **10 Nm (1.0 mkg)**

10. Adjust:
    - Clutch cable free play
      Refer to the "CLUTCH ADJUSTMENT" section in CHAPTER 3°.

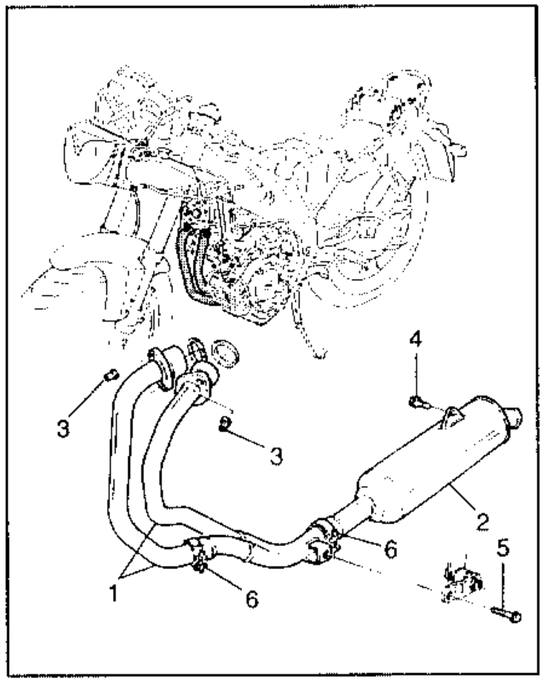
	Free play: **10 ~ 15 mm** **at clutch lever end**

11. Install:
    - Carburetor (to intake manifolds)

	Screw (carburetor joint clamp–left): **2 Nm (0.2 mkg)** **Screw (carburetor joint clamp–right):** **5 Nm (0.5 mkg)**

12. Connect:
    - Air cleaner joints to carburetors

	Screw (carburetor manifold clamp–left): **2 Nm (0.2 mkg)** **Screw (carburetor manifold clamp–right):** **5 Nm (0.5 mkg)**



13. Install:
    - Exhaust pipe (1)
    - Muffler (2)

	Nuts (3) (exhaust pipe): **10 Nm (1.0 mkg)** **Muffler mounting bolts (4):** **40 Nm (4.0 mkg)** **Bolt (5):** **23 Nm (2.3 mkg)** **Bolt (6) (clamp):** **10 Nm (1.0 mkg)**

14. Install:
    - Radiator

	Bolt (radiator): **10 Nm (1.0 mkg)**

15. Connect:
    - Battery cables

CAUTION:

Connect first the positive (+) cable, then the negative (–) cable.

16. Fill:
    - Radiator
    - Coolant reservoir tank
      See the section "COOLANT CHANGE" in CHAPTER 3°.

17. Install:
    - Fuel tank
    - Seat
    - Cowling
      See the sections "SEAT, FUEL TANK AND REAR COWLING" and "COWLING" in CHAPTER 3°.